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UNIVERSITY OF WYOMING

COOPERATIVE RESEARCH REPORT TO THE BUREAU OF LAND MANAGEMENT

1963 Results

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HALOGETON RESEARCH

Arid Land Studies of Grazing Treatments, Ecology,
Shrub Improvement and Control, and Moisture Relationships

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BMITTED BY WYOMING AGRICULTURE EXPERIMENT STATION DECEMBER, 1963

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S E C T I O N I

WINTER SHEEP GRAZING STUDY ON SALTSAGE RANGE (GREYBULL) 1963

Introduction

The experimental pastures used in the winter sheep grazing study were established in 1956, by cooperative agreement between the Bureau of Land Management, the Bureau of Reclamation, and the Wyoming Agricultural Experiment Station. The pastures are located approximately 15 miles northwest of Greybull, Wyoming, (T53N, R95W, Sec. 3) in an arid area dominated by saltsage (Atriplex nuttallii). An average of 4.87 inches of precipitation has fallen during the past four years as measured by a University of Wyoming rain gauge (Table 1).

The study was initiated by the above agencies for 3 objectives. These were to determine the effect of different grazing intensities on:

1. The spread of Halogeton (Halogeton glomeratus),
2. The production of saltsage, and
3. The response of the sheep, measured in terms of weight change.

The third objective was discarded after the 1960 study because of the greatly increased number of sheep needed to obtain the desired grazing intensities in a short period of time. It was also felt that the decreased grazing period would make any comparison of weight between different intensities meaningless.

The 924 animals used in the 1963 grazing period were again furnished by Mr. Harry Grabbert of Emblem, Wyoming, to whom the authors are deeply indebted for his kind cooperation.

TABLE 1. PRECIPITATION DATA (IN INCHES) FROM UNIVERSITY OF WYOMING RAIN GAUGES, DRY FORK HALOGETON PASTURES, 1960 - 1963.

Precipitation Periods	Years 1960	1961	1962	1963	Avg.	Percent of Total
Winter October 15 - April 15	1.00	0.87	0.81	1.34	1.00	20.53
Spring April 15 - July 1	0.60	1.35	3.01	3.78	2.18	44.77
Summer July 1 - September 1	0.72	0.11	1.35	0.21	0.60	12.32
Fall September 1 - October 15	0.40	1.82	0.30	1.82	1.09	22.38
Total	2.72	4.15	5.47	7.15	4.87	100%
Growth Period Total	1.72	3.28	4.66	5.81	3.87	

Methods and Procedures

The study area consists of 640 acres which is divided into fenced pastures (Figure 1). The original modified randomized block design, which was employed from 1956 through 1962, consisted of a holding pasture and two replications of pastures for light, moderate, and heavy utilization, at 20, 40, and 80 percent use, respectively. These replicated pastures were 160, 80, and 40 acres in area. Following the 1962 grazing season it became apparent that response, measured in terms of saltsage production, was significantly different among the three rates of utilization. To more accurately determine the optimum rate of utilization a new treatment was initiated. The 160-acre light use pastures were each divided into two 80-acre pastures. Optimum use on pastures 4a and 7a remained at 20 percent but was increased to 30 percent on pastures 4b and 7b (Figure 1).

Production of saltsage was determined by clipping 10 plots, each 100 square feet in area, in each pasture prior to the grazing season. Utilization measurements were taken by similar clipping procedures following the removal of the sheep.

Determination of numbers of sheep per pasture and days of grazing were computed on an optimum forage consumption of 4.0 pounds per animal per day. Individual pasture differences in soil, topography, and resultant herbage production variations necessitated some manipulation of sheep numbers in the attempt to obtain the optimum grazing intensities.

Vegetational analyses were conducted by the point frame method on ten permanent 50-foot line transects in each pasture. Vegetation was evaluated on the basis of 300 point recordings on each transect by systematic placement of the point frame which contained 10 pins.

1963 Results

During the 1963 season the pastures were grazed for 20 days, commencing on November 2 and ending on November 22. Water was hauled to the sheep in a 1350 gallon tank, rented from the city of Lovell, with a large truck supplied by the Bureau of Land Management. A total of 924 head of sheep, including rams, were placed on the pastures. Pasture numbers, size in acres, optimum rate of utilization, and numbers of sheep placed in each unit are given below:

Pasture Number	Acres	Rate of Use		Number of Sheep 1962	Number of Sheep 1963
1	80	Moderate	40%	100	127
2	40	Heavy	80%	90	120
4a	80	Slight	20%	125	81
4b	80	Light	30%		113
5	80	Moderate	40%	110	156
6	40	Heavy	80%	90	141
7a	80	Slight	20%	135	76
7b	80	Light	30%		110

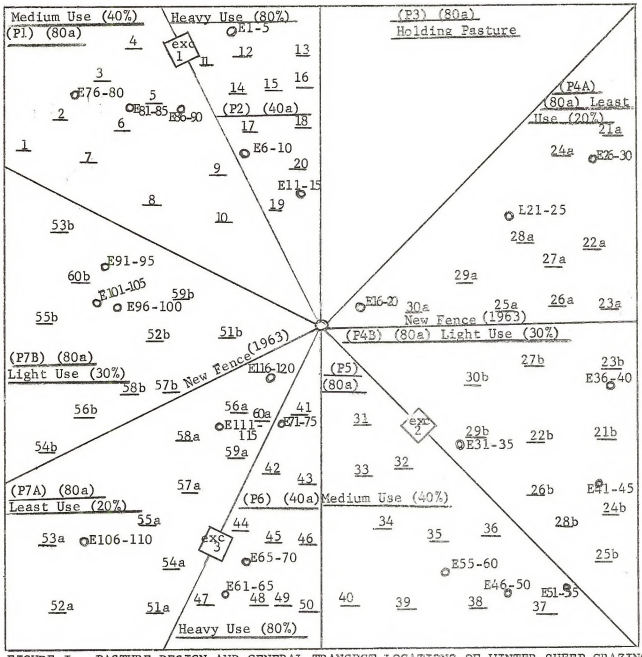


FIGURE I. PASTURE DESIGN AND GENERAL TRANSECT LOCATIONS OF WINTER SHEEP GRAZING STUDY ON THE DRY FORK DRAINAGE, GREYBULL, WYOMING.
E25-30 refers to erosion transect cluster areas.
34 refers to saltsage study transects.

Production of saltsage on all pastures was greater in 1963 than in 1962 (Table II). The increase in production was 31% on the light use pastures, 49% on the moderate use, and 66% on the heavy use pastures. Most of this increase can be attributed to very favorable moisture conditions which prevailed, especially in the latter part of the growing season (Table I). In 1963, from April 15th to June 30th, 3.78 inches of rainfall was recorded, and from August 30th until October 15th, another 1.82 inches was recorded. This compares with 1.35 and 1.82 inches respectively, for the same periods in 1961. In 1962, 3.01 and 0.30 inches occurred. The precipitation increase of greatest significance in comparing the years 1962 and 1963 was that noted during the fall period (Sept. 1 - Oct. 15). The great increase (more than 600 percent) from 0.30 to 1.82 inches resulted in vigorous fall regrowth and also reduced shattering loss which occurs when the plants are extremely dry during the grazing period.

The measured utilization rates in 1963 were extremely close to the desired intensities. Note in Table III that the rates were all within 2 percent of the optimum values with the exception of the heavy use pastures. These pastures were grazed very heavily in an attempt to increase the 6-year mean toward the desired figure of 80 percent. This was accomplished by raising the 5-year mean of 73.53 percent to 76.32 percent for the 6-year mean. The other percentages for the 6-year mean compare favorably with the desired levels.

Vegetational data which were derived from the line point transects are given in Tables IV and V. These data show that there is a marked variation between both the percentage of cover and the percentage of composition of the heavy use pasture and the moderate and light use pastures with respect to saltsage. Although the range is more evident in the percentage of composition, as it was in 1962, with a difference of 13 percent between the heavy and moderate, while the variation is only 6 percent between moderate and light; it is evident in the percentage of cover also. The saltsage cover in the heavy use pastures was 13.84 percent in 1963, while in 1962 it was 12.06, which represents a gain of only 1.78 percent. The saltsage cover in the moderate pastures also showed little response to the increased precipitation; the cover in 1963 was 16.70 percent as compared to 15.26 in 1962, or a gain of only 1.44 percent. However, the light use pastures showed a remarkable gain, the 4 pastures having a 19.05 percent cover of saltsage as compared to 13.50 in 1962. This shows a gain of 5.65 percent in the cover of saltsage for these pastures. This increase in saltsage cover is an excellent indication of the changes which are occurring in these pastures due to the different grazing intensities. However, this difference is not shown in the pasture means for the different rates of utilization. This is due to the fact that large numbers of annual weeds were found in both the moderate and heavy use pastures which, in a wet year such as 1963, produce a large amount of ground cover. Another interesting exception is the presence of prickly pear (Opuntia polyacantha) in all pastures in almost equal amounts. The different grazing intensities seem to have little effect upon its percent of cover or composition. The definite lack of perennial grasses in the light use pastures was noted, as in previous years, but cannot be fully explained.

TABLE II. PRODUCTION OF SALTSAGE UNDER DIFFERENT INTENSITIES OF GRAZING (POUNDS AIR-DRY FORAGE PER ACRE) ON THE DRY FORK HALOGETON PASTURES - 1963.

	Rate of Utilization and Pasture Numbers								
	Slight - 20%		Light - 30%		Moderate - 40%		Heavy - 80%		Mean
Year	4a	7a	4b	7b	1	5	2	6	
1958	166.8	165.9			136.8	186.7	117.1	184.8	159.7
Mean	166.4				161.8		150.9		
1959	225.9	221.1			212.9	255.9	107.5	235.8	209.8
Mean	223.5				234.4		171.6		
1960	129.2	95.6			106.3	108.9	71.7	67.9	96.6
Mean	112.4				107.6		69.8		
1961	152.9[a]	119.1[abc]			102.1[bc]	121.6[ab]	42.9	85.1[c]	103.9
Mean	136.0				111.8		64.0		
1962	282.2[d]	300.8[d]			232.3[bc]	242.5[c]	201.6[ab]	197.8[a]	242.9
Mean	291.5[c]				237.4[b]		199.7[a]		
1963	404.0	382.0	378.0	367.0	318.0	390.0	302.0	362.0	362.8
Mean	393.0		372.5		354.0		332.0		

TABLE III. SHEEP DAYS PER ACRE AND PERCENTAGE UTILIZATION UNDER DIFFERENT INTENSITIES OF GRAZING ON THE DRY FORK HALOGETON PASTURES - 1963.

	Sheep Days Per Acre	Percent Utilization of Saltsage
Slight Use - 20%		
1958	9.51	6.50
1959	14.77	31.30
1960	7.79	11.60
1961	6.95	17.79
1962	14.63	28.60
1963	19.62	19.50
Mean	12.21	19.21
Light Use - 30%		
1963	27.87	28.40
Moderate Use - 40%		
1958	18.48	36.00
1959	30.47	54.00
1960	13.79	39.47
1961	12.31	30.39
1962	23.63	48.30
1963	35.37	38.37
Mean	22.34	41.08
Heavy Use - 80%		
1958	34.50	54.60
1959	55.31	86.60
1960	16.82	74.10
1961	15.08	80.98
1962	37.13	71.35
1963	66.25	90.31
Mean	37.51	76.32

TABLE IV. PERCENTAGE VEGETATIVE COVER, UNDER DIFFERENT INTENSITIES OF GRAZING ON THE DRY FORK HALOGETON PASTURES - 1963.

Species	20% Slight Use		30% Light Use		40% Moderate Use		80% Heavy Use	
	4a	7a	4b	7b	1	5	2	6
Atriplex nuttallii	17.96	18.89	18.86	20.50	17.00	16.41	14.93	12.75
Halogeton glomeratus	1.70	.40	-	1.33	-	.50	1.28	3.01
Descurania pinnata	.76	.62	.55	-	.70	.65	.30	1.05
Lepidium densiflorum	.30	-	-	-	-	.30	-	.30
Artemisia spinescens	-	-	-	3.30	1.32	-	-	.85
Opuntia polyacantha	2.30	1.70	7.00	.60	2.52	.67	1.80	2.00
Astragalus spp.	-	-	-	-	.50	-	-	-
Musineon divaricatum	-	-	.30	.70	.90	-	.30	-
Lupinus spp.	-	-	-	-	.90	-	-	-
Aster canescens	-	-	-	-	1.78	2.00	-	2.00
Sphaeralcea coccinia	-	-	-	-	.70	-	-	-
Lappula redowskii	1.38	1.14	.43	.40	-	1.00	.89	1.97
Stanleya viridiflora	.30	.30	.30	.30	.30	.30	.74	.43
Monolepis nuttallii	.30	1.30	.30	3.00	-	.30	1.52	-
Allium textile	.30	.72	.30	.43	-	.30	.40	.43
Salsola kali	-	-	-	-	.30	-	-	.85
Sitanion hystrix	-	.80	-	-	.70	1.85	.30	3.00
Poa secunda	-	-	-	1.00	-	.70	-	-
Oryzopsis hymenoides	-	-	-	-	.30	-	1.70	-
Pasture Total	24.30	25.87	28.04	31.56	27.92	24.98	24.16	28.64
Treatment Means	25.08		29.80		26.45		26.40	

TABLE V. PERCENTAGE COMPOSITION UNDER DIFFERENT INTENSITIES OF GRAZING ON THE DRY FORK HALCGETON PASTURES - 1963.

	20% Slight Use		30% Light Use		40% Moderate Use		80% Heavy Use	
Species	4a	7a	4b	7b	1	5	2	6
Atriplex nuttallii	91.17	88.25	94.05	90.14	83.26	89.04	79.15	67.30
Halogeton glomeratus	.71	.80	-	1.67	-	.20	7.41	14.22
Descurania pinnata	1.39	1.15	.99	-	.03	.70	.64	1.13
Lepidium densiflorum	.51	-	-	-	-	.17	-	.18
Artemisia spinescens	-	-	-	1.23	1.48	-	-	.95
Opuntia polyacantha	.90	.73	2.62	.24	3.44	1.78	.70	2.26
Astragalus spp.	-	-	-	-	.46	-	-	-
Musineon divaricatum	-	-	.17	.36	2.24	-	.24	-
Lupinus spp.	-	-	-	-	2.06	-	-	-
Aster canescens	-	-	-	-	5.25	2.15	-	2.39
Sphaeralcea coccinia	-	-	-	-	.38	-	-	-
Lappula redowskii	4.27	2.70	1.04	.51	-	1.17	3.80	5.76
Stanleya viridiflora	.28	.41	.17	.38	.35	.87	2.08	.81
Monolepis nuttallii	.23	3.47	.19	4.41	-	.41	3.50	-
Allium textile	.45	1.71	.74	.69	-	.59	1.38	.49
Salsola kali	-	-	-	-	.36	-	-	.98
Sitanion hystrix	-	.71	-	-	.38	2.52	.42	3.50
Poa secunda	-	-	-	.37	-	.33	-	-
Oryzopsis hymenoides	-	-	-	-	.38	-	.68	-

S E C T I O N . I I

SUMMER STEER GRAZING STUDIES ON SALTSAGE RANGE (WORLAND) 1963

Introduction

The North Fork Experimental Pastures, located on the North Fork of the 15-Mile drainage (R94W, T48N, S30), were established in 1960 by cooperative agreement between the Bureau of Land Management and the Wyoming Agricultural Experiment Station. These pastures are located approximately 12 miles west of Worland, Wyoming, in an area dominated principally by saltsage (Atriplex nuttallii). Annual precipitation is light--an average of 6.93 inches occurred over the last four years (Table I).

Two pastures were established for comparison of animal and vegetation responses (Figure 1). One pasture, which consisted of 521.3 acres, was treated with waterspreaders and seeded to crested wheatgrass (Agropyron cristatum), tall wheatgrass (Agropyron elongatum), and fireweed (Kochia scoparia). Seeding was conducted on approximately 190 acres of the spreader system in 1960. It was found during the summer of 1963 that a successful grass stand was established on 42 acres. The untreated check pasture consisted of 488.8 acres of native saltsage (Atriplex nuttallii) range.

For the past four years, the yearling steers used in the study have been furnished by the Wyoming Agricultural Substation at Powell, Wyoming.

Methods and Procedures

Production of herbage was estimated by clipping plots 9.6 sq. ft. in area, which were systematically located along each vegetational analysis transect. These plots were caged during the grazing period and clipped at the end of the growing season on September 15.

Utilization was estimated on the basis of percentage of weight removed. Ten samples were taken on each transect by placing a 2 ft. x 2 ft. frame at 5-foot intervals. The check pasture utilization was estimated in a similar manner except that a 1 ft. x 9.6 ft. frame was utilized to insure inclusion of adequate plant cover.

Individual weights were recorded for each animal when placed on the pastures and again upon removal.

During the summer of 1963, erosion transects were installed with three clusters of five transects each located in each of the two pastures. The transects will be read at three-year intervals to determine the possible influence of grazing treatment upon rate of soil movement.

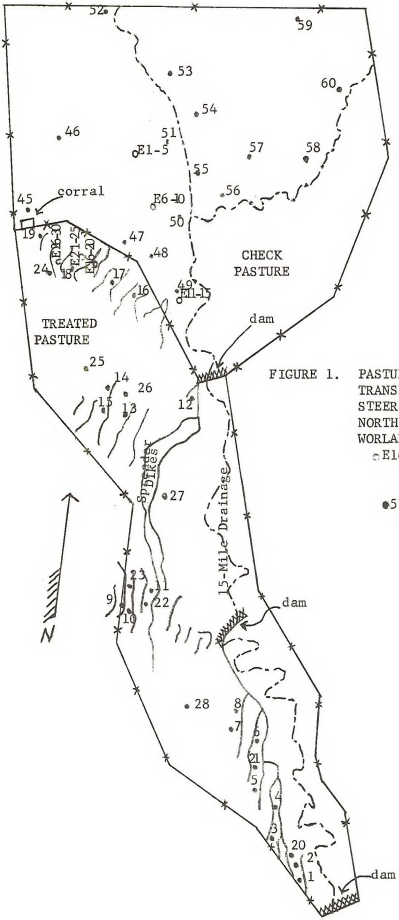


FIGURE 1. PASTURE DESIGN AND GENERAL TRANSECT LOCATIONS OF SUMMER STEER GRAZING STUDY IN THE NORTH FORK 15-MILE DRAINAGE, WORLAND, WYOMING.

○E16-20 Refers to Erosion Transect Cluster Areas

●57 Refers to Herbage Study Areas

1963 Results

Forty-nine yearling steers were grazed for 83 days during the summer of 1963 from July 25th until October 15th, with 13 head on the check pasture and 36 head on the treated pasture. Water was hauled to the steers from mid-July to mid-September. Although spring runoff was sufficient to cover the entire spreader system, the reservoir capacities were greatly reduced due to silting. A truck and water trailer were provided by the Bureau of Land Management.

Animal responses indicated an advantage of 4.46 pounds per acre gain per day on the treated area, and an average daily gain which was 56 percent greater on the seeded pasture than on the check pasture. The treated pasture also carried 2.8 times the number of cattle that were carried on the native pasture (Table II).

No vegetational analyses were made. These are conducted on a bi-yearly basis and 1963 was an interim year. However, observations indicated that many of the vegetational trends noted in 1962 were the same in 1963. Western wheatgrass (Agropyron smithii) was seen in more areas than in 1962. The mats which it formed were thicker and several of the dike areas supported considable seedlings. Several of the woody species mentioned in the 1962 report also increased. Both silver sagebrush (Artemisia cana) and willows (Salix spp.) appeared to be present in greater numbers, while in the main drainages large numbers of cottonwood (Populus spp.) seedlings were noted. The tamarix (Tamarix spp.) did not appear to have increased in number. If these woody species continue to increase, they may well replace the grasses in the more mesic areas of the spreader system.

The growth of weedy annuals was very limited in the interdike areas and on the native range areas. Nuttall monolepis (Monolepis nuttallii) and halogeton (Halogeton glomeratus), which were abundant in 1962, were very small in size and non-existant in many areas during 1963.

Herbage production this year on both treated and native range types was less than measured in 1962 (Table III). In the treated area the production of crested wheatgrass (Agropyron cristatum) was 1421.70 pounds of air dried herbage per acre, a decrease of about ten percent from the previous year. Tall wheatgrass (Agropyron elongatum) production dropped from 447.38 pounds per acre to 153.50 pounds per acre, a decrease of approximately 60 percent. Annual production of saltsage decreased approximately 12 percent on both the check pasture and the unaffected area of the treated pasture to 490.10 and 442.60 lbs. per acre respectively. These decreases were probably due to the extremely dry period during July and August when considerable leaf shattering occurred.

Herbage utilization also decreased in 1963, with only 28.62 percent of the crested wheatgrass and 5.00 percent of the tall wheatgrass being grazed as compared to 38.17 and 7.50 percent utilization for the respective species in 1962 (Table IV). It is felt that the majority of the decrease is due to the late date at which the study began (July 25). The grasses of the seeded area had, for the most part, completely matured and dried before the cattle could use them and shrub utilization in the waterways was increased. Also,

as in previous years, the large clumps of the tall wheatgrass offered protection from grazing for this species and reduced utilization. The crested wheatgrass was also somewhat protected in like manner. Because of the advanced stage of maturity and the protection offered by these older plants, much of the grazing was confined to areas where seedlings were present. As a result, pattern of utilization was irregular. Clipping or mowing the "wolf plants" of these seeded areas every few years might result in more uniform grazing over the entire area. An earlier grazing period would undoubtedly be desirable.

In the check pasture and in the native areas of the treated pasture utilization of the saltsage was almost non-existent. As is shown in Table IV, the total utilization of these areas was 0.7 and 0.6 percent, respectively, and this percentage utilization could be derived from mere curoisty on the part of the steers. In the native pasture, as in previous years, the saltsage was grazed only when all other native species had been utilized. The increase in grass and shrubby species may account for the reduction of saltsage utilization in the native pasture from 6.9 percent to 4.8 percent, a decrease of 30.0 percent.

TABLE I. PRECIPITATION DATA (in inches) FROM UNIVERSITY OF WYOMING RAIN GAUGE, NORTH FORK EXPERIMENTAL AREA, 1960-1963.

	YEARS					
Precip. Periods	1960	1961	1962	1963	Avg.	Percent of Total
Winter Oct. 15 - Apr. 15	-	1.85	1.13	1.19	1.39	20.06
Spring Apr. 15 - July 1	2.06	2.44	3.82	4.75	3.27	47.18
Summer July 1 - Sept. 1	0.93	0.34	1.32	0.53	0.78	11.26
Fall Sept. 1 - Oct. 15	1.42	2.75	0.60	1.19	1.49	21.50
Total	-	7.38	6.87	8.66	6.93	100.00
Growth Period Total	4.41	5.53	5.74	6.47	5.54	

TABLE II. STOCKING RATE AND ANIMAL RESPONSE, NORTH FORK EXPERIMENTAL AREA, 1960 to 1963.

	Check				Treated			
	1960	1961	1962	1963	1960	1961	1962	1963
No. of days grazed	43	43	73	83	43	43	73	83
No. of animals	18	13	12	13	35	35	31	36
A.U.D.'s 1/ per acre	1.52	1.32	1.79	2.21	2.95	2.89	4.34	5.73
Avg. daily gain per animal	0.46	0.70	0.98	0.66	0.82	1.60	1.30	1.03
Lbs. gain per acre	0.70	0.87	1.75	1.46	2.41	4.64	5.64	5.92

1/ Animal Unit Days

TABLE III. PRODUCTION OF AIR-DRY FORAGE IN POUNDS PER ACRE ON THE NORTH FORK EXPERIMENTAL AREA, 1960 to 1963.

	Treated Pasture								
	Seeded Area			Unaffected Area			Check Pasture		
Species	1960	1962	1963	1960	1962	1963	1960	1962	1963
Agropyron cristatum	570.6	1580.6	1421.7						
Agropyron elongatum	579.3	447.4	153.5						
Agropyron spicatum	P*						P		
Bouteloua gracilis			P				P		
Munroa squarrosa				P			P		P
Oryzopsis hymenoides	P			P			P		
Poa secunda				P	P				
Sitanion hystrix	122.0		P	P	P	102.0		P	P
Sporobolus cryptandrus				P			P		
Halogeton glomeratus	13.1			P			P	P	P
Kochia scoparia	183.0	12.3							P
Misc. uniden. forbs	P	P		P	P		P	P	
Artemisia spinescens				P			P		
Atriplex nuttallii	61.0	P		217.8	516.0	442.6	274.4	559.6	490
Musineon divaricatum					10.3			P	P
Plantago purshii					P			P	P
Machaeranthera tanacetifolia					12.3			16.7	P

*P=Present, but less than 5# per acre.

TABLE IV. PERCENTAGE UTILIZATION OF MAJOR SPECIES ON THE NORTH FORK EXPERIMENTAL AREA, 1960 to 1963

	Treated Pasture								
	Seeded Area			Unaffected Area			Check Pasture		
Species	1960	1962	1963	1960	1962	1963	1960	1962	1963
Agropyron cristatum	47.3	38.17	28.62	-	-	-	-	-	-
Agropyron elongatum	38.3	7.50	5.00	-	-	-	-	-	-
Sitanion hystrix	39.3	-	-	-	-	-	-	-	-
Kochia scoparia	33.4	-	-	-	-	-	-	-	-
Atriplex nuttallii	77.1	-	-	29.8	Trace	Trace	54.3	6.9	4.8
Total Utilization			13.8			0.6			0.7

SECTION III

EXCLOSURE STUDIES (PRODUCTION, COVER, HEIGHT AND PRECIPITATION PHASE) 1963

Introduction

Vegetation production studies on exclosures and relict areas of the Big Horn and Wind River Basins were initiated during the 1962 field season. Most of the exclosures were constructed in 1959 and 1960.

Earlier investigations consisted of vegetation analysis by cover and composition determinations with point frames on permanently located quadrats and evaluation of soil characteristics. Quadrat studies were to be rerun at five-year intervals. The next series of these data will be obtained during the summer of 1964.

Specific objectives of the present study are listed in the 1962 annual report. General goals consist of determining the relationship of forage production to plant height, cover, and plot frequency, time and amount of precipitation, and several range improvement practices. Several years data will be required prior to comprehensive analysis.

Methods and Procedures

Area cover, herbage production, and height data studies on sagebrush-grass sites were conducted on transects of 20 quadrats, 12 in. sq., spaced systematically along a randomly located 100 ft. steel tape. On sites dominated by saltsage, data were obtained in like manner except that plot size was 1x10 ft. The plot frame was placed at right angles to the steel tape and vegetation data were subdivided into ten subplots.

Area cover of herbaceous and low growing semi-woody species was estimated within each square foot plot. Shrub crown cover, including cactus and phlox, was estimated within the square foot plots, but these data were not combined when comparing area cover to forage production.

Forage production was determined by clipping herbaceous species at ground or crown level. Clippings were oven-dried at 70° C. for 24 hours prior to weighing. Exclosures were clipped on the same date as the previous year.

Height data were recorded only for the more important species. These were measured on a metric basis and will be correlated with weight and precipitation data in future years.

Precipitation data were recorded from simple aluminum rain gauges installed at each exclosure. Precipitation data were recorded four times a year -- April 15, July 1, September 1, and October 15.

1963 Results

Production studies were conducted on 29 exclosures. A list of plants from all study sites is presented in Table I. Vegetation and precipitation data are presented on the following tables.

Included in these data are those from four exclosures constructed during the spring of 1963 in the Cumberland District near Kemmerer. Sagebrush control will be conducted on these during the spring of 1964.

TABLE I. LIST OF PLANT NAMES WHICH OCCURRED IN PRODUCTION STUDY AREAS

Code	Genus	Species	Common	Life Form	Longevity
AGSM	Agropyron	smithii	Western Wheatgrass	Grass	Perennial
AGSP	Agropyron	spicatum	Bluebunch Wheatgrass	Grass	Perennial
ALTE	Allium	textile	Textile Onion	Forb	Perennial
ANDI	Antennaria	dimorpha	Low Pussytoe	Forb	Perennial
ARPE	Artemisia	petatifida	Brown Sagebrush	Half Shrub	Perennial
ARSP	Artemisia	spinescens	Bud Sagebrush	Half Shrub	Perennial
ARTR	Artemisia	tridentata	Big Sagebrush	Shrub	Perennial
ASCA	Aster	canescens	Hoary Aster	Forb	Perennial
AST	Astragalus spp.		Milkvetch	Forb	Perennial
ATAR	Atriplex	argentea	Silverscale Saltbush	Forb	Annual
ATNU	Atriplex	nuttallii	Nuttall Saltbush	Half Shrub	Perennial
BOGR	Bouteloua	gracilis	Blue Grama	Grass	Perennial
BRTE	Bromus	tectorum	Cheatgrass	Grass	Annual
CAFI	Carex	filifolia	Threadleaf Sedge	Sedge	Perennial
CAS	Castilleja spp.		Paintbrush	Forb	Perennial
CHE	Chenopodiaceae Family		Goosefoot Family		
CHLA	Chenopodium	lanceolatum	Lambsquarter Goosefoot	Forb	Annual
CHVI	Chrysothamnus	viscidiflorus	Green Rabbitbrush	Shrub	Perennial
COPA	Commandra	pallida	False Toadflax	Forb	Perennial
CRAC	Crepis	acuminatus	Tapertip Hawksbeard	Forb	Perennial
CYLO	Cymopteris	longipes	Chimaya	Forb	Perennial
DES	Descurania spp.		Tansymustard	Forb	
ERI	Erigeron spp.		Fleabane	Forb	Perennial
EREF	Eriogonum	effusum	Spreading Eriogonum	Forb	Perennial
EROV	Eriogonum	ovalifolium	Cushion Eriogonum	Forb	Perennial
ERSU	Eriogonum	subalpinum	Subalpine Eriogonum	Forb	Perennial
EULA	Eurotia	lanata	Winterfat	Half Shrub	Perennial
FEOC	Festuca	octoflora	Sixweek Fescue	Grass	Annual
GUSA	Gutierrezia	sarothrae	Broom Snakeweed	Half Shrub	Perennial
HAGL	Halogeton	glomeratus	Halogeton	Forb	Annual
KOCR	Koeleria	cristata	June Grass	Grass	Perennial
KOSC	Kochia	scoparia	Fireweed	Forb	Annual
LARE	Lappula	redowskii	Stickseed	Forb	Annual
LEDE	Lepidium	densiflorum	Prairie Pepperweed	Forb	Annual
LEPE	Lepidium	perfoliatum	Clasping Pepperweed	Forb	Annual
LEPU	Leptodactylon	pungens	Granite Gilia	Forb	Perennial
MER	Mertensia spp.		Bluebells	Forb	Perennial
MONU	Monolepis	nuttalliana	Nuttall Monolepis	Forb	Annual
MUDI	Musineon	divaricatum	Falsecarrot	Forb	Perennial
OEAL	Oenothera	albicaulis	Pale Evening Primrose	Forb	Perennial
OPPO	Opuntia	polyacantha	Plains Prickly pear	Forb	Perennial
ORHY	Oryzopsis	hymenoides	Indian Ricegrass	Grass	Perennial
PEN	Penstemon spp.		Penstemon	Forb	Perennial
PHHO	Phlox	hoodii	Hood's Phlox	Forb	Perennial
PLPU	Plantago	purshii	Wooly Indianwheat	Forb	Annual
PLSP	Plantago	spinescens	Spiny Indianwheat	Forb	Annual
POA	Poa spp.		Bluegrass	Grass	Perennial
POFE	Poa	fendleriana	Muttongrass	Grass	Perennial
POSE	Poa	secunda	Sandberg Bluegrass	Grass	Perennial
SAKA	Salsola	kali	Russian Thistle	Forb	Annual
SAVE	Sarcobatus	vermiculatus	Greasewood	Shrub	Perennial
SIHY	Sitanion	hystrix	Squirreltail Bottlebrush	Grass	Perennial
SIS	Sisymbrium spp.		Tumblemustard	Forb	
SPCO	Sphaeralcea	coccinea	Scarlet Globemallow	Forb	Perennial
SPAI	Sporobolus	airoides	Alkali Sakaton	Grass	Perennial

TABLE I. LIST OF PLANT NAMES WHICH OCCURRED IN PRODUCTION STUDY AREAS (CONTINUED)

Code	Genus	Species	Common	Life Form	Longevity
SPCR	Sporobolus	cryptandrus	Sand Dropseed	Grass	Perennial
STA	Stanleya spp.		Princess Plume	Forb	
STCO	Stipa	comata	Needle and Thread	Grass	Perennial
STVI	Stipa	viridula	Green Needlegrass	Grass	Perennial
TECA	Tetradymia	canescens	Gray Horsebrush	Shrub	Perennial
TESP	Tetradymia	spinosa	Spiny Horsebrush	Shrub	Perennial
TRI	Trifolium spp.		Clover spp.	Forb	
UMB	Umbelliferae Family		Carrot Family		

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Size 1x1 — Cover Determined by Area Estimate — No. Plots 20

Smilo Exc. 7/24/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurrences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
Non-spray	A	B	C	D	E	F	G	H	I
*ARTR	295.00	14.75	-	-	10	-	-	-	-
PLPU	4.50	.22	5.68	-	8	3.51	.44	.78	16.85
AGSM	16.00	.80	20.64	16.50	9	8.46	.94	.53	40.61
POSE	21.00	1.05	27.09	-	15	8.25	.55	.39	39.60
BRTE	1.50	.08	2.06	-	3	.36	.13	.24	1.73
SIHY	10.00	.50	12.90	-	5	2.28	.46	.23	10.94
BOGR	22.00	1.10	28.38	-	4	2.39	.58	.11	11.47
FEOC	1.00	.05	1.29	-	2	.36	.18	.36	1.73
STCO	1.50	.08	2.06	-	2	2.00	1.00	1.33	9.60
TOTAL		3.88				27.61			132.53
Sprayed									
*OPPO	3.00	.15	-	-	1	-	-	-	-
PLPU	.50	.02	.36	-	1	.02	.02	.04	.10
AGSM	3.50	.18	3.28	16.20	6	2.38	.39	.68	11.42
POSE	63.50	3.18	57.88	-	14	21.18	1.51	.33	101.66
BOGR	2.00	.10	1.82	-	1	.13	.13	.06	.62
SIHY	18.00	.90	16.38	-	12	9.89	.82	.55	47.47
BRTE	8.50	.42	7.64	-	15	2.76	.18	.32	13.25
STCO	4.00	.20	3.64	-	2	3.31	1.66	.83	15.89
FEOC	10.00	.50	9.10	-	5	2.99	.60	.30	14.35
TOTAL		5.50				42.66			204.76

*Not computed in Percent Composition

Precipitation Data:

R.G. 36 - Macaroni Pit

October 15 to April 15	=	1.76
April 15 to July 1	=	4.14
July 1 to September 1	=	0.68
September 1 to October 15	=	1.81
Growth Season Total	=	6.63

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Sweetwater Exc. 7/30/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/sq. ft.	Average Weight per Plot Occurrences F ÷ E	Weight/Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*ARTR	80.00	4.00	-	-	5	-	-	-	-
*CHVI	12.00	.60	-	-	4	-	-	-	-
*PHHO	3.50	.18	-	-	4	-	-	-	-
*OPPO	1.00	.05	-	-	1	-	-	-	-
*ALTE	1.50	.08	-	-	3	-	-	-	-
*Broadleaf perennial	.50	.02	-	-	1	-	-	-	-
STCO	152.00	7.60	70.60	15.20	17	49.15	2.89	.32	235.90
AGSM	8.50	.42	3.90	-	9	6.27	.67	.74	30.09
POSE	5.50	.28	2.60	-	7	3.43	.49	.62	16.46
KOCR	3.50	.18	1.67	-	5	.76	.15	.22	3.65
CAFI	45.50	2.28	21.18	-	15	8.47	.56	.19	40.66
TOTAL		10.76				68.08			326.76

*[illegible]omputed in Percent Composition

Precipitation Data:

R.G. 11 - Happy Springs

October 15 to April 15	=	-
April 15 to July 1	=	4.74
July 1 to September 1	=	.71
September 1 to October 15	=	-
Growth Season Total	=	-

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 — No. Plots 20

Cover Determined by Area Estimate

Two-Mile Hill Exc. 7/17/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 200	Total Weight Gms/200 / sq.ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
ATNU	1608.5	8.04	79.29	-	110	638.78	5.81	.40	306.61
*OPPO	24.0	.12	-	-	4	-	-	-	-
*PHHO	4.0	.02	-	-	2	-	-	-	-
ORHY	6.5	.03	.30	-	8	8.67	1.08	1.33	4.16
BRTE	512.5	2.06	20.32	-	198	181.89	.92	.35	87.31
SIHY	.5	.01	.01	-	4	.15	.04	.30	.07
TOTAL		10.14				829.49			398.15

*Not computed in Percent Composition

Precipitation Data:

R.G. 39 - Two-Mile Hill Exclosure

October 15 to April 15	=	3.32
April 15 to July 1	=	6.43
July 1 to September 1	=	.47
September 1 to October 15	=	2.94
Growth Season Total	=	9.84

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

P[illegible] Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Upper Gov't Draw Exc. 8/28/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
Non-sprayed	A	B	C	D	E	F	G	H	I
*ARTR	192.00	9.60	-	-	7	-	-	-	-
*PHHO	68.00	3.40	-	-	15	-	-	-	-
*PEN	3.00	.15	-	-	1	-	-	-	-
*SIS	.50	.02	-	-	1	-	-	-	-
AGSM	26.00	1.30	56.03	-	20	19.63	.98	.76	94.22
POSE	12.00	.60	25.86	-	10	3.36	.34	.28	16.13
KOCR	8.50	.42	18.10	-	7	3.65	.52	.43	17.52
TOTAL		2.32				26.64			127.87
Sprayed									
*PHHO	3.50	.18	-	-	3	-	-	-	-
*OPPO	12.00	.60	-	-	1	-	-	-	-
AGSM	65.00	3.25	70.65	-	20	46.63	2.33	.72	223.82
POSE	18.00	.90	19.56	-	14	3.57	.26	.20	17.14
KOCR	9.00	.45	9.78	-	2	4.09	2.04	.45	19.63
TOTAL		4.60				54.29			260.59

*Not computed in Percent Composition

Precipitation Data:

R.G. 9 - Upper Government Draw Exclosure

October 15 to April 15	=	.23
April 15 to July 1	=	5.70
July 1 to September 1	=	.63
September 1 to October 15	=	.67
Growth Season Total	=	7.00

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 — No. Plots 20

Cover Determined by Area Estimate

West Pasture Exc. 7/10/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 200	Total Weight Gms/200 /sq.ft.	Average Weight per Plot Occurrences F ÷ E	Wgt./ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
ATNU	1413.5	7.07	77.77	-	128	556.80	4.35	.39	267.26
ARSP	59.0	.30	3.30	-	8	18.10	2.26	.31	8.69
ARPE	22.0	.11	1.21	-	6	4.65	.76	.21	2.23
Annual Forb	200.6	1.00	11.00	-	168	329.23	1.96	1.64	158.02
*OPPO	565.0	2.82	-	-	64	-	-	-	-
SIHY	24.0	.12	1.32	-	20	12.53	.62	.52	6.01
POSE	90.5	.45	4.95	-	50	40.99	.82	.45	19.68
AGSM	1.5	.01	.11	-	4	.30	.08	.20	.14
ORHY	2.5	.01	.11	-	6	.24	.04	.10	.12
*BOGR	0.5	-	-	-	2	-	-	-	-
TOTAL		9.07				962.84			462.15

*Not computed in Percent Composition

Precipitation Data:

R.G. 13 West Pasture Exclosure

October 15 to April 15	=	1.16
April 15 to July 1	=	4.54
July 1 to September 1	=	.13
September 1 to October 15	=	1.07
Growth Season Total	=	5.74

S E C T I O N I V

SOIL MOISTURE AND TEMPERATURE STUDY
1963

Introduction

Sagebrush control by chemical spraying has long been recognized as an effective means of increasing forage production on rangelands. Little is known about the actual reasons for the increase, however. The release of moisture for herbaceous growth following death of the shrubs has been the common explanation. Other changes in environmental characteristics occur also, but have not been fully evaluated. A complete study of environmental and physiological variations associated with sagebrush control is necessary. Study of these factors may allow development of grazing procedures which will enhance the rate and degree of forage increase.

A study was initiated during the spring of 1963 to evaluate and compare soil moisture and soil temperature relationships in adjacent sagebrush spray and non-spray sites. Data were collected in two areas. The Granite Mountain Exclosure east of Lander was constructed in 1962. Sagebrush was controlled in one-half of the exclosure during the spring of 1962. The Smilo Exclosure, southeast of Worland, was constructed in 1961, and sagebrush was controlled in half of the fenced area during the same spring.

Methods and Procedures

Soil moisture was determined by the use of a neutron scattering meter. Eight permanent probe holes were located at each study site as follows: four inside the exclosure with two in the sprayed areas and two in the non-sprayed; four outside the exclosure with two in the sprayed area and two in the non-sprayed. The probe holes consisted of metal tubes, 2 inches in diameter, which were inserted into the soil to a depth of approximately 6 feet. The probe holes were installed in May, 1963. The neutron scattering meter recorded soil moisture on a volume basis (inches of moisture per 12 inches of soil).

In June, 1963 six thermister probes were installed at each exclosure for the purpose of measuring soil temperature. These were installed at two locations inside each exclosure; one in the sprayed area and one in the unsprayed. At each location the thermister probes were placed at the following depths: 8 inches, 15 inches, and 22 inches. Temperatures were read at a 1 inch depth with a portable surface probe. During the summer rodents destroyed the lead cables from the buried sensitive elements in the Smilo Exclosure. These will be replaced during 1964 with suitable precautions against rodent damage.

1963 Results

The results of the soil moisture study are presented in Tables I and II. The study was of such short duration - less than a year - that no attempts have been made to interpret or draw conclusions from it. The project will be continued and as sufficient data is collected the affect of sagebrush spraying on soil moisture and soil temperature will be determined. The soil temperature study is of the same status and will continue. The data are presented in Table III.

One observation of interest is that very little moisture variation occurred below the 36 inch depth.

TABLE I. GRANITE MOUNTAIN EXCLOSURE: SOIL MOISTURE READINGS (INCHES OF MOISTURE PER 12 INCHES OF SOIL) AS AFFECTED BY SAGEBRUSH SPRAYING, 1963.

Soil Depth	June 24		September 6		October 12		January 10	
	S 1/	N 2/	S	N	S	N	S	N
Inside Exclosure								
6"	2.65	2.32	1.56	1.29	1.50	1.23	1.44	1.71
12"	3.09	2.72	2.06	1.70	2.04	1.65	1.66	2.21
18"	3.12	2.96	2.30	1.66	2.25	1.60	1.59	2.30
24"	2.68	2.19	2.23	1.59	2.15	1.54	1.49	2.15
36"	1.94	1.61	1.95	1.52	1.95	1.48	1.43	1.92
48"	1.88	1.65	1.88	1.66	1.89	1.64	1.57	1.88
60"	1.71	1.53	1.72	1.54	1.76	1.51	1.48	1.68
Outside Exclosure								
6"	2.43	2.39	1.46	1.51	1.37	1.53	1.62	1.52
12"	3.09	2.93	2.11	1.94	2.07	1.92	2.16	1.97
18"	3.18	2.77	2.36	2.34	2.27	2.31	2.22	2.32
24"	2.78	2.54	2.20	2.29	2.04	2.26	2.07	2.25
36"	2.27	1.73	2.30	2.03	2.33	1.84	2.24	1.98
48"	1.65	1.79	1.74	1.84	1.68	1.80	1.66	1.74
60"	1.69	1.51	1.72	1.53	1.71	1.54	1.61	1.53

1/ Spray Area
2/ Non-Spray Area

TABLE II. SMILO EXCLOSURE: SOIL MOISTURE READINGS (INCHES OF MOISTURE PER 12 INCHES OF SOIL) AFFECTED BY SAGEBRUSH SPRAYING, 1963.

Soil Depth	June 27 S 1/	June 27 N 2/	September 5 S	September 5 N	October 13 S	October 13 N	January 10 S	January 10 N
Inside Exclosure								
6"	1.62	1.55	1.39	1.24	1.58	1.37	2.29	1.90
12"	2.12	2.15	1.92	1.80	1.89	1.83	1.97	1.87
18"	1.69	1.80	1.68	1.73	1.68	1.70	1.64	1.74
24"	1.63	1.99	1.63	1.94	1.63	1.95	1.57	1.96
36"	1.97	1.96	2.03	1.90	2.03	1.90	2.04	1.91
48"	2.83	1.64	2.85	1.62	2.88	1.65	2.82	1.67
60"	2.75	1.40	2.77	1.39	2.76	1.41	2.78	1.42
Outside Exclosure								
6"	2.36	1.44	2.15	1.36	2.02	1.17	2.38	1.62
12"	2.16	2.07	2.02	1.83	2.07	1.84	1.90	1.85
18"	1.91	1.62	1.85	1.50	1.88	1.55	1.81	1.48
24"	1.91	1.47	1.92	1.40	1.97	1.41	1.89	1.43
36"	2.16	1.40	2.11	1.42	2.19	1.39	2.17	1.36
48"	1.62	1.54	1.67	1.72	1.70	1.75	1.66	1.74
60"	1.30	1.81	1.30	1.78	1.28	1.80	1.30	1.82

1/ Spray Area
2/ Non-Spray Area

TABLE III. SOIL TEMPERATURE READING FROM GRANITE MOUNTAIN AND SMILO EXCLOSURES, 1963.

Soil Depth	Granite Mountain Exclosure Non-Spray 6-24 (°C)	9-5 (°C)	10-12 (°C)	1-10 (°C)	Smilo Exclosure Non-Spray 6-27 (°C)	9-5 (°C)	10-13 (°C)	1-10 (°C)
1"	37.0	25.5	16.3	-3.3	33.3	Thermisters destroyed by Rodents		
8"	21.0	17.6	13.2	-2.8	23.8			
15"	20.3	17.3	12.6	-2.2	24.3			
22"	19.7	16.5	13.0	-1.1	23.2			
	Spray				Spray			
1"	43.3	28.3	14.0	-3.9	33.3	Thermisters destroyed by Rodents		
8"	20.5	18.2	12.8	-2.8	24.0			
15"	19.0	17.2	12.5	-2.2	24.5			
22"	18.0	16.8	12.9	-1.1	23.3			

S E C T I O N V

EROSION TRANSECT STUDY
1963

Introduction

The erosion transect study program was initiated during the summer of 1963 by cooperative agreement of the Bureau of Land Management, the Bureau of Reclamation and the Wyoming Agricultural Experiment Station. These transects were installed to determine the influence of grazing intensity and some improvement practices upon degree and rate of soil movement. Transects were installed on the Dry Fork Experimental Pastures near Greybull which are grazed at three intensities of saltbush utilization during the winter. On the watershed studies on the Fifteen Mile drainage, erosion transects were installed in the native saltbush range pasture and in the pasture treated with waterspreaders. Transects were also located in four new exclosures in the Cumberland District near Kemmerer. These exclosures were located on the following vegetation types: 1. Greasewood, 2. Low Sagebrush, 3. Big Sagebrush and 4. Nuttall's Saltbush. Shrubs will be controlled in one half of each of the first three exclosures.

All transects will be read at three year intervals.

Methods and Procedures

Each transect consisted of two, 48 inch reinforcement rods (½" diam.) driven into the ground so that only 10 inches remained visible. These were spaced six feet apart. An aluminum label affixed to one rod of each pair designated the zero end of the transect line. Cluster areas consisted of five transects located in a circle about a center marker rod.

Transect reading procedure consisted of placing a 72 inch U-bar over the tops of the two vertical rods. A 72 inch angle iron was placed on the soil surface so that each end was touching one of the two vertical rods. The U-bar and the angle iron were marked at six inch intervals. Beginning six inches from the edge of the zero rod, ten readings were taken at the six inch interval marks. Each reading was the vertical distance in centimeters from the ground surface to the bottom of a meter stick held horizontally onto the top of the U-bar. Readings were taken on the side of the transect facing toward the center of the cluster circle. Vegetation encountered at the point of soil contact of each reading was recorded.

1963 Locations

Dry Fork Halogeton Pastures

Three clusters of five transects each were installed in each of the eight fenced grazing intensity units of the Dry Fork Halogeton Pastures. Within each pasture one cluster was located on a ridge, one on a saltbush flat, and one in a drainageway area. Cluster area locations are shown on the map of the pasture system which is presented in Section I of this report.

Fifteen Mile Watershed Pastures

The Fifteen Mile Watershed study area consists of two pastures. In the non-treated native saltbush range pasture, three clusters of five transects were established. One cluster was located on a ridgetop, one on a saltbush flat, and one in a drainageway area. Three clusters were also established in the pasture treated with the waterspreader system and seeded to crested wheatgrass (Agropyron cristatum) and tall wheatgrass (A. elongatum). One cluster was located in a grass area between dikes. Another was placed in a scraped and seeded area in which the grasses did not become established. The third cluster was located on a natural saltbush flat area contiguous to the waterspreader system. Cluster area locations within the pastures are shown in the map in Section II of this report.

Cumberland Exclosures

During the spring of 1963, four exclosures were constructed by the Bureau of Land Management in the Cumberland Grazing Unit near Kemmerer. The exclosures, titled Cumberland #1, #2, and #3, are located in greasewood, low sagebrush, and big sagebrush, respectively. During the spring of 1964 one-half of each exclosure will be sprayed to control shrubs. A cluster of five transects was located in each of what are to be "spray" and "non-spray" areas in each of the exclosures. Cumberland #4 exclosure is in the saltbush type and will not be sprayed. A single cluster of five transects was established in this exclosure.

S E C T I O N V I

GERMINATION AND LONGEVITY OF HALOGETON SEEDS

Introduction

The Wyoming Agricultural Experiment Station, in cooperation with the Agriculture Research Service and the Agricultural Experiment Stations of Idaho, Nevada, Utah and Washington, is studying the effects of burial at different depths and at different geographical locations on the longevity of black and brown forms of halogeton. (Halogeton glomeratus). Packets, each containing 100 black and 100 brown seeds were buried at depths of 0, 1, 3, and 6 inches. The results of the Wyoming trial are presented in the accompanying Table. The black form of seeds germinated very readily under field conditions, however, the brown form of the seed was slower to germinate. The seed burial was initiated in 1956. In 1958 and 1960 the brown form of the seed still had a relatively high germination at the surface, but in 1961, after four years of burial, the germination was much lower. In 1963 the germination was still lower, with only one seed germinating. The viability of the seeds was also extremely low, with none of the seed examined showing viability. However, after six years some of the brown form of halogeton seed were still able to germinate under laboratory conditions.

TABLE I. GERMINATION AND LONGEVITY RESULTS OF THE 1963 EXHUMED HALOGETON SEEDS

Burial Period (Years)	Burial Depth (Inches)	Field Results: Germinated or Disintegrated		Field Results: Sound or Ungerminated		Laboratory Results: Germination of Sound Seeds		Laboratory Results: Viability of Ungerminated Seeds	
		Black	Brown	Black	Brown	Black	Brown	Black	Brown
1	0	100	0.0	-	100	-	24.00	-	100
	1	100	0.0	-	100	-	0.0	-	100
	3	100	0.0	-	100	-	0.0	-	100
	6	100	0.0	-	100	-	0.0	-	100
2	0	100	3.80	-	96.2	-	23.80	-	50.0
	1	100	1.00	-	99.0	-	7.80	-	52.5
	3	100	1.00	-	99.0	-	0.00	-	80.0
	6	100	4.50	-	95.5	-	0.20	-	42.5
4	0	100	1/	-	1/	-	0.02	-	1/
	1	100		-		-	0.00	-	
	3	100		-		-	0.00	-	
	6	100		-		-	0.01	-	
6	0	100	72.7	-	27.3	-	0.00	-	0.0
	1	100	31.3	-	68.7	-	0.00	-	0.0
	3	100	18.5	-	81.5	-	0.26	-	0.0
	6	100	32.5	-	67.5	-	0.00	-	0.0

1/ Data not available.

S E C T I O N V I I

PRECIPITATION PATTERN STUDY
1963

Introduction

During the 1960 season, over 70 gauges were installed throughout the Big Horn and Wind River Basins at 6 to 12 mile intervals. In addition, some 25 gauges were set up by University of Wyoming personnel under the Federal Halogeton Program in the Rawlins and Rock Springs areas. All gauges are read on the same dates four times a year - April 15, July 1, September 1, and October 15. Personnel of the Worland, Lander, Rawlins, and Rock Springs Districts of the Bureau of Land Management cooperate with the University in reading the instruments.

The U.S. Weather Bureau and the U. S. Geological Survey are able to provide additional information from independent locations. This cooperative effort provides an effective network for future evaluation of precipitation patterns. Identification symbols and general locations for the gauges in the Big Horn and Wind River Basins are designated on the following map.

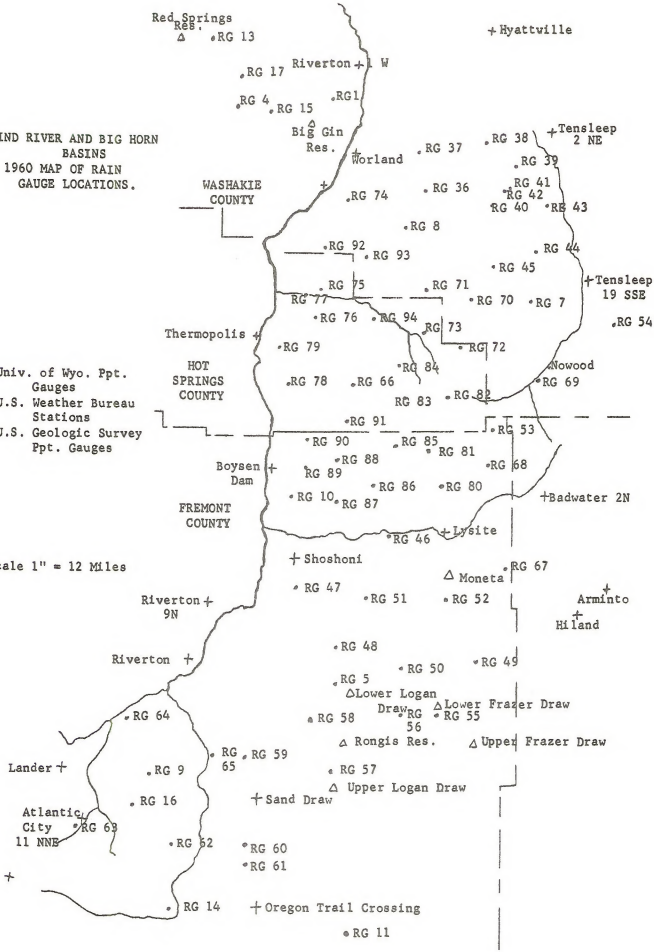
1963 Results

Gauges were set up on four new exclosures of the Bureau of Land Management Cumberland Grazing Unit southwest of Kemmerer. These gauges are being read by Soil Conservation Service personnel from Cokeville.

Precipitation data for 1963 from the University gauges are presented in Table I. Data from the U.S. Weather Bureau stations are presented in Table II. Although some dry and warm periods did occur during the year, most of the precipitation records indicate that moisture was somewhat more abundant than in 1962, which was generally accepted as being a good growing year.

Precipitation data of greatest significance during 1963 resulted from slow late spring rains that occurred throughout June and resulted in an extended forage growth period into the summer.

Summer and fall rains were spotty and fewer in number than in 1962. On areas where fall rains did occur, considerable vegetation green-up was noticed.


WIND RIVER AND BIG HORN BASINS
1960 MAP OF RAIN GAUGE LOCATIONS.
• Univ. of Wyo. Ppt. Gauges
+ U.S. Weather Bureau Stations
△ U.S. Geologic Survey Ppt. Gauges
Scale 1" = 12 Miles
WASHAKIE COUNTY
HOT SPRINGS COUNTY
FREMONT COUNTY
Red Springs Res.
Riverton
Hyattville
Big Gin Res.
Worland
Tensleep 2 NE
Tensleep 19 SSE
Thermopolis
Nowood
Boysen Dam
Badwater 2N
Lysite
Shoshoni
Moneta
Arminto
Hiland
Riverton 9N
Riverton
Lower Logan Draw
Lower Frazer Draw
Rongis Res.
Upper Frazer Draw
Upper Logan Draw
Lander
Sand Draw
Atlantic City 11 NNE
Oregon Trail Crossing
RG 1
RG 4
RG 5
RG 8
RG 9
RG 11
RG 13
RG 14
RG 15
RG 16
RG 17
RG 36
RG 37
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RG 88
RG 89
RG 90
RG 91
RG 92
RG 93
RG 94
RG 10
RG 7

TABLE I. PRECIPITATION DATA FOR 1963 FROM UNIVERSITY OF WYOMING GAUGES FOR THE PERIODS - OCTOBER 15-APRIL 15 (WINTER), APRIL 15-JULY 1 (SPRING), JULY 1-SEPTEMBER 1 (SUMMER), AND SEPTEMBER 1-OCTOBER 15 (FALL).

Rain Gauge Number	Rain Gauge Name	Winter	Spring	Summer	Fall	Total	Average 1961 to 1963
1	Ant Hill Exc. Worland	1.25	4.20	0.27	1.75	7.47	7.60
2	Farson Exc.	----	2.14	1.77	0.82	----	----
3	L.U. Sheep Company	1.76	7.10	0.91	1.91	11.68	11.73
4	Dutch Nick Flats Exc.	1.18	5.00	0.70	1.31	8.19	7.70
5	Ant Plot Exc. Lander	1.43	4.25	1.46	0.77	7.91	7.67
6	Granite Mountain Exc.	----	5.01	1.59	0.83	----	----
7	Buffalo Creek Exc.	2.75	4.03	----	3.99	----	----
8	Demer Exc.	2.03	3.72	0.54	1.74	8.03	8.81
9	Gov't. Draw No. 1 Exc. (No.)	0.23	5.70	0.63	0.67	7.23	8.19
10	Boysen Exc.	0.21	4.26	0.26	1.50	6.23	5.43
11	Happy Springs Exc.	----	4.74	0.71	----	----	----
12	Horse Creek Exc.	4.25	4.34	0.55	1.57	10.71	10.89
13	West Pasture Exc.	1.16	4.54	0.13	1.07	6.90	6.60
14	McGraw Flat Exc.	2.23	5.64	0.87	0.64	9.38	8.54
15	15-Mile Study Pasture	1.19	4.75	0.53	1.19	7.66	7.30
16	Gov't. Draw No. 2 Exc. (So.)	1.83	6.27	1.07	0.48	9.65	9.71
17	Burnt Wagon Exc.	----	5.00	0.40	0.84	----	----
18	Cedar Mtn. Exc.	1.73	----	2.54	0.32	----	----
19	Radio Tower	1.75	2.85	2.53	1.56	4.86	6.10
20	Black Mtn.	1.77	1.13	1.53	0.43	8.69	6.61
23	Sheep Springs	4.10	6.90	0.49	1.85	13.34	14.10
24	Halogeton Pastures	1.34	3.78	0.21	1.82	7.15	5.59
25	Red Wash Exc. #3	2.52	2.02	2.02	1.62	8.18	7.56
26	Red Wash Exc. #1	----	5.55*	1.48	1.27	8.30	7.02
27	Little Robber Exc. #5	4.40	2.64	0.95	2.56	10.55	8.72
28	Red Wash Exc. #2	2.15	1.76	1.35	0.93	6.19	5.92
30	Boar's Tusk	1.89	2.45	1.88	0.86	7.08	6.92
31	Cumber Exc. #1	----	----	started	1.64	----	----
32	Cumber Exc. #2	----	----	started	1.48	----	----
33	Cumber Exc. #3	----	----	started	1.50	----	----
34	Cumber Exc. #4	----	----	started	1.27	----	----
36	Macaroni Pit	1.76	4.14	0.68	1.81	8.39	9.32
37	Sand Draw	1.20	2.08	0.53	1.77	5.58	6.49
38	Shephard Dome	1.98	2.84	0.79	3.14	8.75	9.07
39	Two Mile Hill Exc.	3.32	6.43	0.47	2.94	13.16	11.93
40	North Butte	----	----	----	----	----	----
41	Castle Ridge	----	5.75	0.53	2.20	----	----
42	Little Cottonwood Res.	2.61	5.08	0.60	2.12	10.41	10.32
43	Gov't Anderson Dry Hole	0.95	3.54	0.51	2.91	7.91	7.23
44	Gordon	2.72	4.77	1.00	3.55	12.04	10.86
45	Warner and Lewis	1.35	----	0.98	2.10	----	----
46	Gibbs Butte	0.74	3.50	0.62	1.40	6.26	7.32
47	Muskrat	0.95	3.43	1.36	1.18	6.92	----
48	Fuller Seed Plot	1.28	4.60	1.16	1.08	8.12	8.38
49	Canyon Creek	----	5.18	1.74	2.43	----	----
50	Muskrat#5 Exc.	1.68	3.87	1.33	1.42	8.30	8.58
51	Poison Creek	1.11	3.14	1.40	1.94	7.59	8.21
52	Alkali Flats	1.26	4.32	0.51	2.46	8.55	9.37
53	Cottonwood Pass Exc.	3.06	----	----	1.64	----	----
54	Conner	----	6.03	----	----	----	----

*Includes winter precipitation

TABLE I. PRECIPITATION DATA FOR 1963 FROM UNIVERSITY OF WYOMING GAUGES FOR THE PERIODS-OCTOBER 15-APRIL 15 (WINTER), APRIL 15-JULY 1 (SPRING), JULY 1-SEPTEMBER 1 (SUMMER), AND SEPTEMBER 1-OCTOBER 15 (FALL). (Continued)

Rain Gauge Number	Rain Gauge Name	Winter	Spring	Summer	Fall	Total	Average 1961 to 1963
55	Fraser Seed Plot	1.60	4.46	----	----	----	----
56	Logan #1 Exc.	1.58	4.75	2.20	0.64	9.17	8.00
57	Logan #2 Exc.	2.40	4.73	0.62	0.55	8.30	7.91
58	Empty Cartridge Exc.	1.78	3.82	0.54	0.37	6.51	----
59	Carter Divide Exc.	1.60	3.91	0.84	0.44	6.79	6.34
60	Dishpan Butte #1 Exc.	1.89	5.39	1.15	0.49	8.92	10.01
61	Dishpan Butte #2 Exc.	1.25	4.90	1.17	0.48	7.80	8.04
62	Hall Creek Exc.	2.53	6.36	0.53	0.65	10.07	10.28
63	Little Popo-Agie	1.50	5.76	0.85	0.56	8.67	9.62
64	Hudson	1.70	5.85	0.60	0.69	8.84	8.56
65	Pan American	1.58	4.62	0.75	0.63	7.58	----
66	Buffalo	2.82	6.78	0.35	1.30	11.25	----
67	Madden	----	4.27	2.02	2.07	----	----
68	Johnson	0.53	4.13	1.02	1.67	7.35	----
69	No Wood	1.76	6.02	2.09	1.19	11.06	14.35
70	Andrews	1.19	2.94	0.42	2.66	7.21	7.42
71	Hayes Bros.	1.75	3.92	0.98	1.52	8.17	9.00
72	Seaman	1.99	3.45	0.61	1.68	7.73	9.00
73	Black Mtn. (Walker)	1.80	5.22	0.21	1.58	8.81	9.35
74	No Water Canal	1.73	2.13	----	0.97	----	----
75	Sand Gulch Exc.	2.13	7.35	0.52	1.83	11.83	9.92
76	Cochran Exc.	2.42	6.30	1.50	1.25	11.47	11.07
77	Kirby Creek Exc.	0.16	6.44	0.70	1.70	9.00	9.07
78	Devils Slide	3.09	6.79	0.97	0.85	11.70	12.83
79	Thermopolis	3.06	8.15	0.60	1.32	13.13	13.11
80	Poison Draw	0.58	3.79	1.26	1.40	7.03	7.11
81	Mack Ranch	----	----	2.07	2.36	----	----
82	Gardner	----	7.13	1.03	1.94	----	----
83	Hayes Ranch	----	----	----	----	----	----
84	Pumping Station	----	6.92	0.20	.73	----	----
85	Bridger Creek	----	6.75	0.80	2.65	----	----
86	Dry Creek	0.45	4.41	0.44	1.15	6.45	7.07
87	Hoodoo Creek	0.30	3.63	0.55	1.35	5.83	6.47
88	Comet Mine	----	3.09	0.54	0.55	----	----
89	Birdseye Ranch	1.42	6.36	0.36	1.91	10.05	7.73
90	Birdseye Pass	0.60	----	----	----	----	----
91	Jones Ranch	1.91	6.00	1.48	1.99	11.38	11.82
92	Wildcat	1.06	4.61	0.18	0.82	6.67	8.02
93	Zimmerman	----	----	----	1.24	----	----
94	Lake Creek	----	5.49	0.75	1.60	----	----

TABLE II. PRECIPITATION DATA FROM THE UNITED STATES WEATHER BUREAU STATIONS 1/ FOR THE PERIOD OCTOBER 15, 1962 TO OCTOBER 15, 1963.

	Winter Oct. 15 to April 15	Spring April 15 to July 1	Summer July 1 to Sept. 1	Fall Sept. 1 to Oct. 15	1963 2/ Total	Long 3/ Term Average
Deaver	1.25	3.25	.87	.81	6.18	5.21
Lovell	1.94	2.54	.90	1.16	6.54	6.92
Powell	1.16	4.35	.90	1.43	7.84	5.67
Heart Mtn.	1.74	4.49	.88	1.43	8.54	----
Emblem	1.25	3.73	.81	1.05	6.84	----
Greybull 1S	1.53	4.03	.57	.97	7.10	----
Shell	3.36	4.56	.07	1.28	9.27	----
Basin	1.15	3.61	.27	.93	5.96	6.21
Rairdon 2WSW	1.69	2.69	.44	1.44	6.26	----
Grass Creek	1.51	7.33	.05	.12	9.01	----
Worland	1.34	4.19	.21	1.26	7.00	7.76
Worland FAA AP	1.15	3.54	.78	.19	5.66	----
Thermopolis	1.40	8.02	.70	1.06	11.18	11.01
Thermopolis 25WNW	2.13	9.46	2.08	1.59	15.26	----
Thermopolis 9NE	├──9.55──┤		.64	1.32	11.51	----
Tensleep 19SSE	4.40	6.22	.65	1.06	12.33	----
Boysen Dam	1.49	5.93	1.62	1.28	10.32	----
Lost Cabin 1NNE	.72	4.92	2.56	1.15	9.35	----
Arminto	1.01	2.63	3.08	.82	7.54	----
Shoshoni	.73	3.57	1.92	.70	6.92	----
Pavillion	.71	6.65	.67	.56	8.59	8.67
Diversion Dam	1.19	6.20	1.21	.31	8.91	9.45
Morton 1NW	1.20	5.91	.44	.30	7.85	----
Fort Washakie	2.73	5.58	.72	.37	9.40	11.90
Riverton	.98	5.73	2.01	.36	9.08	8.79
Sand Draw	1.36	4.96	.70	.31	7.33	----
Lander WB AP	3.80	7.55	.59	T	11.94	13.58
Muddy Gap	2.00	3.63	1.79	1.04	8.46	----
Rawlins FAA AP	4.09	2.81	2.75	.21	9.86	----
Wamsutter 1N	.88	1.49	2.01	.86	5.24	----
Rock Springs	2.47	2.61	2.52	1.11	8.71	----
Rock Springs FAA AP	3.61	2.15	3.78	T	9.54	----
Farson	.92	2.97	1.61	1.21	6.71	----
Kemmerer	3.98	2.92	2.04	1.37	10.31	----

1/ Weather Bureau. 1962-1963. Climatological Data-Wyoming U.S. Dept. Commerce. Vols. 71 and 72.

2/ Computed for the period October 15, 1962 to October 15, 1963.

3/ Weather Bureau. 1962. Climatological Data-Wyoming Annual Summary, U.S. Department Commerce. Vol. 71. No. 13.

S E C T I O N V I I I

CUMBERLAND DISTRICT EXCLOSURES
1963

Introduction

During the summer of 1963 four exclosures were constructed on the Cumberland District by the Bureau of Land Management following cooperative determination of specific locations with personnel of the Wyoming Agricultural Experiment Station. The exclosure names and corresponding dominant shrubs are listed as follows:

Cumberland #1 Exclosure - Greasewood and Mixed Shrubs
Cumberland #2 Exclosure - Low Sagebrush
Cumberland #3 Exclosure - Big Sagebrush
Cumberland #4 Exclosure - Nuttall's Saltbush

Objectives of study are: (1) to evaluate the influence of grazing upon the native vegetation, (2) to evaluate vegetational response following shrub control, both in grazed and non-grazed areas of exclosures #1, #2, and #3, and (3) to evaluate the relationship between herbage production and precipitation. Exclosures No. 1, 2, and 3 were divided into two equal portions - half to be sprayed in 1964 for shrub control. The area adjacent to the exclosures are to be similarly treated making a total of four separate treatments: inside spray, inside non-spray, outside spray, outside non-spray. Ten permanent quadrats, 4 feet x 4 feet, were located in each treatment area. The vegetation within each quadrat was measured using a point frame and a total of 100 points. Ten 2 feet x 20 feet charting quadrats and five photo reference points were located in each area. All quadrats and points were permanently located. Exclosure No. 4 was divided into only 2 sub-units; inside and outside. These plots will be read at three-year intervals.

Results of point measurements are summarized in Tables I, II, III, and IV. Atriplex nuttallii and Eurotia lanata were the only shrubs measured by the points method. The soil analyses and vegetation charting are not complete and are not included in the report.

Herbage production studies have been initiated. These data are presented in Section III of this report. Rain gauges have been installed at each exclosure and are being read by the Soil Conversation Service personnel from Cokeville.

TABLE I. PERCENT VEGETATIVE COVER AT CUMBERLAND EXCLOSURE NO. 1, 1963.

Species	Percent Cover				
	Inside Non-Spray	Inside Spray	Outside Non-Spray	Outside Spray	Area Avg.
Shrubs					
ATNU	4.80	1.40	10.10	1.70	4.50
EULA	0.20	-	-	-	.05
Grasses					
AGSM	3.60	1.00	3.50	5.50	3.40
POSE	1.40	1.90	-	3.20	1.62
ORHY	0.10	-	-	-	0.02
SIHY	-	0.30	-	-	0.05
Forbs					
Phlox spp.	0.20	0.20	.30	1.70	0.60
ALTE	0.10	0.10	-	-	0.05

TABLE II. PERCENT VEGETATIVE COVER AT CUMBERLAND EXCLOSURE NO. 2, 1963.

Species	Percent Cover				
	Inside Non-Spray	Inside Spray	Outside Non-Spray	Outside Spray	Area Avg.
Shrubs					
None	-	-	-	-	-
Grasses					
AGSM	6.9	5.4	6.2	6.4	6.2
POSE	6.4	8.7	9.1	7.0	7.8
STLE	0.5	0.4	0.3	0.8	0.5
Forbs					
Phlox spp.	2.0	-	1.3	1.1	1.1
Eriogonum spp.	2.0	4.0	4.0	2.0	3.0
Astragalus spp.	0.2	0.3	0.6	-	0.3
LYJU	0.1	-	0.2	0.6	0.2
Senecio spp.	-	-	-	0.5	0.1
CEAR	4.8	4.2	1.6	4.3	3.7
ERSU	1.1	0.4	1.1	0.2	0.7
COPA	-	0.1	-	-	-

TABLE III. PERCENT VEGETATIVE COVER AT CUMBERLAND EXCLOSURE NO. 3, 1963.

Species	Percent Cover				
	Inside Non-Spray	Inside Spray	Outside Non-Spray	Outside Spray	Area Avg.
Shrubs					
EULA	-	-	-	-	-
Grasses					
AGSM	4.3	4.1	6.7	5.8	5.2
POSE	7.4	4.5	3.6	2.8	4.6
Forbs					
Phlox spp.	3.5	1.4	1.9	3.1	2.5
Eriogonum spp.	.1	.5	.2	.7	.4
Astragalus spp.	-	.7	.4	.4	.4
CHLA	.1	-	-	-	-
CEAR	1.2	.6	1.4	.7	1.0

TABLE IV. PERCENT VEGETATIVE COVER AT CUMBERLAND EXCLOSURE NO. 4, 1963.

Species	Percent Cover		
	Inside	Outside	Area Avg.
Shrubs			
ATNU	11.5	13.1	12.3
EULA	.7	-	.4
Grasses			
AGSM	.5	1.4	1.0
POSE	.1	-	-
ORHY	.3	-	.2
SIHY	-	.2	.1
Forbs			
Phlox spp.	.3	.4	.4

S E C T I O N I X

Effect of Big Sagebrush Control Upon the Cover and Production of Native Forage Species, Snow Cover and Soil Moisture Reception and Depletion 1963

Vegetative Composition

The six-year vegetative survey on the Red Desert plots was completed during the 1962 growing season. The 1962 report included the percentage composition of each species from the initiation of the experiment in 1957 through 1962. It is interesting to note that the initial increase of Low Douglas rabbitbrush (Chrysothamnus viscidiflorus pumulus), which was of major concern on the sprayed areas, has not increased over the past three years but has subsided to about its original density.

Production

The air-dry grass production, Table I, dropped again in 1963. It should not be concluded that the production of the area is decreasing in the proportions indicated by the surveys. The 1963 growing season was very droughty in this area as indiciated in Figure 1. The grass did not green up until adequate moisture was received in the latter part of the growing season. The sprayed area reached its maximum productive capacity three years after spraying, resulting in a three to four-fold increase over the unsprayed areas.

Soil Moisture Studies

Soil moisture measurements using the neutron scattering probe were established in the summer of 1962. Measurements have been conducted on at least a bimonthly frequency since that time.

Figure I shows the total inches of moisture present in the top 5 feet of soil on the Red Desert in both the sprayed and unsprayed areas. These curves show the mean of the five sampling locations.

It can be seen in Figure I that the total moisture in the top 5 feet is consistently greater for the unsprayed area than for the sprayed. This difference may be explained by the fact that since the area has been sprayed (1957) the forage production on the sprayed areas has increased 3- to 4-fold. One may conclude either that the increased grass is able to use more of the total moisture in the soil, or has the ability to withdraw more moisture from the soil than sagebrush.

Figure II shows the average inches per day loss or gain of moisture in the soil between survey dates.

Although the data are limited, there are indications that sagebrush has the capacity to utilize immediately any moisture received, whereas native forage species are slower to respond to moisture.

TABLE I. AIR-DRY FORAGE PRODUCTION ON SPRAYED AND UNSPRAYED AREAS ON THE RED DESERT. 1/

Year	Pounds Air-dry Forage Per Acre	
	Sprayed	Unsprayed
1959	190	98
1960	632	118
1961	542	48
1962	375	167
1963	182	84
5-year Average	384	103

1/ Plots sprayed in 1957; no forage production obtained in 1958 as a result of the area being grazed by cattle before exclosures were established.

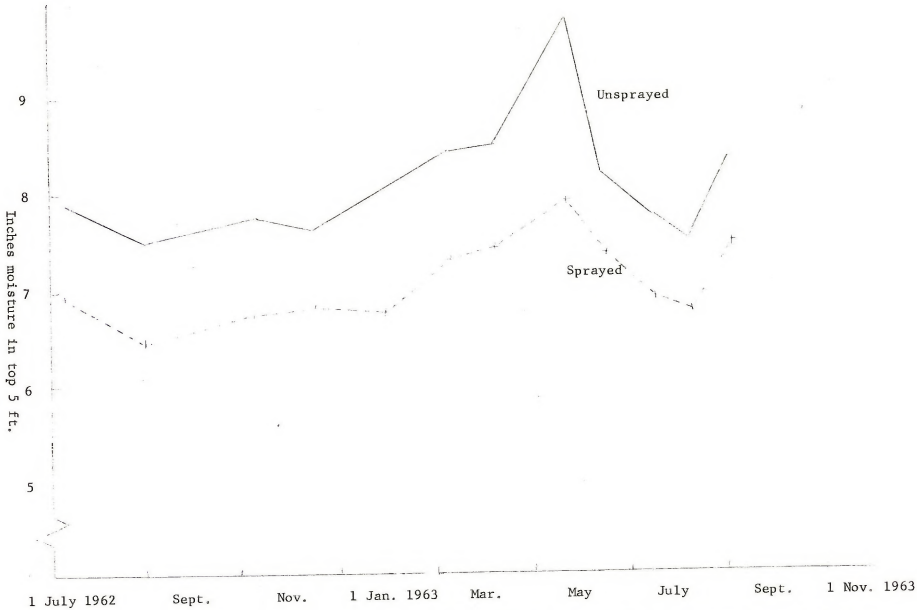

Figure 1. Total inches of moisture present in the top 5 feet of soil in both sprayed and unsprayed areas.

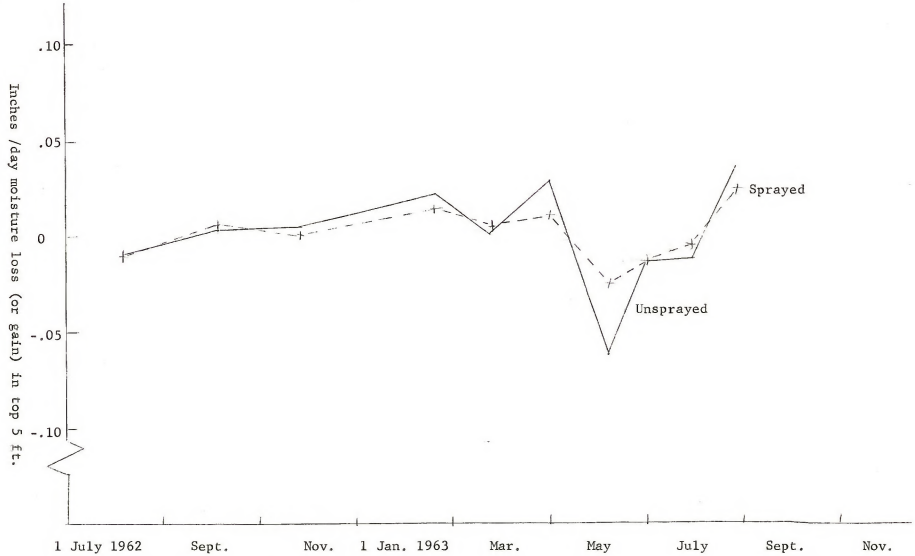

Figure 2. Average inches per day gain or loss of moisture in the soil between dates of sampling.

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 No. Plots 20

Cover Determined by Area Estimate

nt Eradi-cation Lander Exc. 8/19/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*ARTR	196.00	9.80	-	-	11	-	-	-	-
*SPCO	.50	.02	-	-	1	-	-	-	-
*PHHO	5.00	.25	-	-	2	-	-	-	-
*OPPO	100.00	5.00	-	-	2	-	-	-	-
STCO	16.00	.80	20.94	-	6	15.55	2.59	.97	74.64
POSE	26.00	1.30	34.02	-	7	11.57	1.65	.44	55.54
AGSM	20.50	1.02	26.69	-	17	21.01	1.18	.98	100.85
BOGR	12.00	.60	15.70	-	1	2.17	2.17	.18	10.42
STHY	2.00	.10	2.62	-	1	2.10	2.10	1.05	10.08
TOTAL		3.82				52.40			251.53

*Not computed in Percent Composition

Precipitation Data:

G. 5 - Ant Plot Exclosure (Lander)

October 15 to April 15	=	1.43	(Winter)
April 15 to July 1	=	4.25	(Spring)
July 1 to September 1	=	1.46	(Summer)
September 1 to October 15	=	.77	(Fall)
Growth Season Total	=	6.48	

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Boysen Exc. 7/30/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20 /sq. ft.	Average Weight per Plot Occurrences F ÷ E	Wgt./ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
SAKA	.50	.02	.12	-	1	.18	.18	.36	.86
SPCO	5.00	.25	1.45	-	6	4.42	.72	.88	21.22
*OPPO	64.00	3.20	-	-	3	-	-	-	-
AST	1.50	.08	.46	-	2	.45	.23	.30	2.16
BOGR	112.00	5.60	32.54	-	17	38.17	2.24	.34	183.20
SPCR	225.00	11.25	65.36	-	8	10.76	1.34	.05	51.65
TOTAL		17.20				53.98			259.09

*Not computed in Percent Composition

Precipitation Data:

R.G. 10 - Boysen Exclosure

October 15 to April 15	=	.21
April 15 to July 1	=	4.26
July 1 to September 1	=	.26
September 1 to October 15	=	1.50
Growth Season Total	=	6.02

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Bud Kimball Exc. 7/17/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/sq. ft.	Average Weight per Plot Occurrences F ÷ E	Weight/Unit Basal Area F ÷ A	Pounds per Acre
Non-Spray	A	B	C	D	E	F	G	H	I
*ARTR	224.00	11.20	-	-	12	-	-	-	-
*OPPO	71.00	3.55	-	-	3	-	-	-	-
PLPU	1.50	.08	1.61	-	3	.17	.05	.00	.82
*PHHO	.50	.02	-	-	1	-	-	-	-
AGSM	21.50	1.08	21.71	19.80	13	12.91	.99	.60	61.97
POSE	76.00	3.80	76.38	-	17	20.76	1.22	.27	99.65
STHY	.50	.02	.40	15.00	1	.15	.15	.30	.72
TOTAL		4.98				33.99			162.98
Sprayed									
*ARTR	12.50	.62	-	-	3	-	-	-	-
*OPPO	25.40	1.27	-	-	4	-	-	-	-
AGSM	45.00	2.25	36.88	24.40	19	27.88	1.47	.62	133.82
POSE	77.00	3.85	63.10	-	17	35.02	2.06	.45	168.10
*STCO	.50	.02	.33	-	1	-	-	-	-
TOTAL		6.10				62.90			301.92

*Not computed in Percent Composition

Precipitation Data:

R.G. 42 - Little Cottonwood Res.

October 15 to April 15	=	2.61
April 15 to July 1	=	5.08
July 1 to September 1	=	0.60
September 1 to October 15	=	2.12
Growth Season Total	=	7.80

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Buffalo Creek Exc. 7/25/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20 / sq. ft	Average Weight per Plot Occurrences F ÷ E	Wgt. / Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*ARTR	55.00	2.75	-	-	3	-	-	-	-
EULA	2.00	.10	-	-	1	.22	.22	.11	.53
*OPPO	22.50	1.02	-	-	2	-	-	-	-
SPCO	1.00	.05	.63	-	2	.11	.06	.11	.53
*PHHO	12.50	.60	-	-	5	-	-	-	-
*PLSP	.50	.02	-	-	1	-	-	-	-
*DES	.50	.02	-	-	1	-	-	-	-
AGSP	106.50	5.32	67.03	24.80	18	65.61	3.64	.62	314.93
AGSM	1.00	.05	.63	13.00	1	.50	.50	.50	2.40
POSE	30.00	1.50	18.90	-	13	5.79	.44	.19	27.79
BRTE	6.00	.30	3.78	-	4	2.76	.69	.49	13.25
BOGR	14.00	.70	8.82	-	2	3.93	1.96	.28	18.86
TOTAL		7.92				78.92			378.29

*Not computed in Percent Composition

Precipitation Data:

R.G. 7 - Buffalo Creek Exclosure

October 15 to April 15	=	2.75
April 15 to July 1	=	4.03
July 1 to September 1	=	----
September 1 to October 15	=	3.99
Growth Season Total	=	----

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 No. Plots 20

Cover Determined by Area Estimate

Burnt Wagon Exc. 7/11/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 200	Total Weight Gms/200 /sq. ft.	Average Weight per Plot Occurrences F ÷ E	Wgt./ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
ATNU	2218.5	11.09	94.26	-	82	817.55	9.97	.37	392.42
MUDI	63.0	.32	2.72	-	48	42.18	.88	.67	20.24
CYLO	7.5	.04	.34	-	16	.23	.01	.03	.11
MONU	21.0	.10	.85	-	40	.30	.01	.01	.14
ALTE	26.0	.13	1.10	-	20	4.83	.24	.19	2.32
SIHY	15.5	.08	.68	-	10	16.21	1.62	1.05	7.78
TOTAL		11.76				881.30			423.01

Precipitation Data:

R.G. 17 - Burnt Wagon Exclosure

October 15 to April 15	=	-
April 15 to July 1	=	5.00
July 1 to September 1	=	.40
September 1 to October 15	=	.84
Growth Season Total	=	6.24

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 No. Plots 20

Cover Determined by Area Estimate

Cochran Exc. 7/25/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute plot Frequency Base 20	Total Weight Gms/20/sq. ft.	Average Weight per Plot Occurrences F x G	Weight/Unit Basal Area F ÷ A	Pounds per Acre
Nonsprayed	A	B	C	D	E	F	G	H	I
*ARTR	118.00	5.90	-	-	9	-	-	-	-
*CHLA	.50	.02	-	-	1	-	-	-	-
*OPPO	12.00	.60	-	-	2	-	-	-	-
*PLSP	1.00	.05	-	-	2	-	-	-	-
*PHHO	1.00	.05	-	-	1	-	-	-	-
AGSM	26.50	1.32	26.45	22.4	18	28.75	1.60	1.08	138.00
POSE	68.00	3.40	68.20	-	16	9.47	.59	.14	45.46
BRTE	5.00	.25	5.02	-	4	.69	.07	.14	3.31
STCO	.50	.02	.40	-	1	1.20	1.20	2.40	5.76
TOTAL		4.99				40.11			192.53
Sprayed									
*ARTR	66.50	3.32	-	-	9	-	-	-	-
*PHHO	.50	.02	-	-	1	-	-	-	-
*PLSP	1.00	.05	-	-	2	-	-	-	-
*PLPU	.50	.02	-	-	1	-	-	-	-
*BRTE	.50	.02	-	-	1	-	-	-	-
AGSM	63.50	3.18	63.20	22.0	19	70.79	3.72	1.11	340.00
POSE	33.00	1.65	32.80	-	14	8.00	.57	.24	38.40
SIHY	4.00	.20	3.97	-	1	5.75	1.15	1.44	27.60
TOTAL		5.03				84.54			406.00

*Not computed in Percent Composition

Precipitation Data:

[illegible] 76 - Cochran Exclosure

October 15 to April 51	=	2.42
April 15 to July 1	=	6.30
July 1 to September 1	=	1.50
September 1 to October 15	=	1.25
Growth Season Total	=	9.05

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Cumberland #1 Exc. 8/7/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/sq. ft.	Average Weight per Plot Occurrences F ÷ E	Wgt./Unit Basal Area F ÷ A	Pounds per Acre
Inside Non-spray	A	B	C	D	E	F	G	H	I
*ARTR	.40	.02	-	-	1	-	-	-	-
*CHVI	51.50	2.58	-	-	6	-	-	-	-
*SAVE	9.50	.48	-	-	3	-	-	-	-
ATNU	310.00	15.50	89.59	-	9	124.84	13.87	2.48	599.23
ATAR	1.00	.05	.28	-	2	.15	.08	.15	.72
AGSM	8.00	.40	2.31	-	11	5.51	.50	.56	26.45
POSE	2.00	.10	.06	-	2	.15	.08	.08	.72
STHY	25.00	1.25	7.22	-	4	.86	.22	.03	4.13
TOTAL		17.30				131.51			631.25
Inside Sprayed									
*ARTR	75.00	3.75	-	-	9	-	-	-	-
*CHVI	93.60	4.68	-	-	10	-	-	-	-
*SAVE	45.00	2.25	-	-	6	-	-	-	-
ATNU	3.00	.15	23.07	-	1	.75	.75	.25	3.60
*PHHO	.50	.02	-	-	1	-	-	-	-
*CHE	.50	.02	-	-	1	-	-	-	-
AGSM	7.50	.38	58.56	-	11	5.07	.46	.68	24.34
POSE	2.50	.12	18.48	-	4	.29	.07	.12	1.39
*ORHY	.40	.02	-	-	1	-	-	-	-
TOTAL		.65				6.11			29.33

*Not computed in Percent Composition

Precipitation Data:

R.G. 31 - Cumberland #1 Exclosure

October 15 to April 15	=	-
April 15 to July 1	=	-
July 1 to September 1	=	Set Up
September 1 to October 15	=	1.64
Growth Season Total	=	-

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Cumberland #2 Exc. 8/15/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Wgt./ Unit Basal Area F ÷ A	Pounds per Acre
Inside Non-spray	A	B	C	D	E	F	G	H	I
*ARAR	189.50	9.48	-	-	13	-	-	-	-
*TECA	3.00	.15	-	-	2	-	-	-	-
*CHVI	17.50	2.38	-	-	8	-	-	-	-
*LEDU	1.00	.05	-	-	2	-	-	-	-
*PHHO	18.00	.90	-	-	11	-	-	-	-
*EREF	45.50	2.28	-	-	9	-	-	-	-
*ERSU	3.00	.15	-	-	5	-	-	-	-
*MER	12.00	.60	-	-	8	-	-	-	-
*TRI	1.50	.08	-	-	3	-	-	-	-
*COPA	4.00	.20	-	-	7	-	-	-	-
AGSM	13.50	.68	46.57	-	13	10.50	.81	.78	50.40
POSE	14.50	.78	53.42	-	8	4.47	.56	.31	21.46
TOTAL		1.46				14.97			71.86
Inside Sprayed									
*ARAR	117.00	5.85	-	-	16	-	-	-	-
*CHVI	66.00	3.30	-	-	10	-	-	-	-
*TECA	3.00	.15	-	-	1	-	-	-	-
*LEDU	19.50	.98	-	-	5	-	-	-	-
*PHHO	11.50	.58	-	-	15	-	-	-	-
*EREF	19.00	.95	-	-	7	-	-	-	-
*ERSU	4.00	.20	-	-	1	-	-	-	-
*TRI	2.00	.10	-	-	4	-	-	-	-
*AST	2.00	.10	-	-	1	-	-	-	-
*MER	13.50	.68	-	-	6	-	-	-	-
*DES	1.00	.05	-	-	2	-	-	-	-
AGSM	18.00	.90	64.28	-	19	17.94	.94	1.00	86.11
POSE	10.00	.50	35.71	-	5	4.24	.85	.42	20.35
TOTAL		1.40				22.18			106.46

*Not computed in Percent Composition

Precipitation Data:

R.G. 32 - Cumberland #2 Exclosure

October 15 to April 15	=	
April 15 to July 1	=	
July 1 to September 1	=	Set up
September 1 to October 15	=	1.48
Growth Season Total	=	

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Cumberland #3 Exc. 8/15/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in. cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
Inside Non-Spray	A	B	C	D	E	F	G	H	I
*ARTR	556.00	27.80	-	-	14	-	-	-	-
*CHVI	17.00	.85	-	-	10	-	-	-	-
*TECA	16.00	.80	-	-	2	-	-	-	-
*PHHO	71.50	.36	-	-	15	-	-	-	-
*EREF	22.50	1.12	-	-	5	-	-	-	-
*TRI	.50	.02	-	-	1	-	-	-	-
AGSM	12.50	.62	57.94	-	8	12.07	1.51	.97	57.94
*AGSP	.50	.02	-	-	1	-	-	-	-
POSE	6.00	.30	28.03	-	7	2.73	.39	.46	13.10
POA	2.00	.10	9.34	-	1	.92	.92	.46	4.42
SIHY	1.00	.05	4.67	-	2	1.43	.71	1.43	6.86
TOTAL		1.07				17.15			82.32
Outside Spray									
*ARTR	603.00	30.15	-	-	17	-	-	-	-
*CHVI	86.00	4.30	-	-	15	-	-	-	-
*PHHO	15.50	.78	-	-	13	-	-	-	-
*EREF	4.00	.20	-	-	1	-	-	-	-
*UMB	.50	.02	-	-	1	-	-	-	-
*AST	1.00	.05	-	-	2	-	-	-	-
AGSM	8.50	.42	89.36	-	16	5.15	.32	.60	24.72
POSE	1.00	.05	10.63	-	13	.39	.03	.39	1.87
TOTAL		.47				5.54			26.59

*Not computed in Percent Composition

Precipitation Data:

R.C. 33 - Cumberland #3 Exclosure

October 15 to April 15 =
April 15 to July 1 =
July 1 to September 1 = Set Up
September 1 to October 15 = 1.50
Growth Season Total =

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 No. Plots 20

Cover Determined by Area Estimate

Cumberland #4 Exc. 9/12/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 200	Total Weight Gms/200 / sq. ft.	Average Weight per Plot Occurrences F ÷ E	Wgt. / Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*ARSP	72.0	.36	-----	-----	40	------	----	----	------
*TESP	7.0	.04	-----	-----	11	------	----	----	------
ATNU	2543.0	12.71	82.15	-----	200	899.68	4.50	.35	431.85
EULA	540.0	2.70	17.45	-----	110	226.19	2.06	.42	108.57
*PHHO	58.0	.29	-----	-----	90	------	----	----	------
AGSM	4.5	.02	.13	-----	50	.46	.01	.10	.22
POSE	3.5	.02	.13	-----	40	1.80	.04	.51	.86
*STVI	5.5	.03	-----	-----	40	------	----	----	------
ORHY	3.5	.02	.13	-----	30	.99	.03	.28	.48
TOTAL		15.47				1129.12			541.98

*Not computed in Percent Composition

Precipitation Data:

R.G. 34 - Cumberland #4 Exclosure
Set Up July 1
September 1 to October 15 = 1.27

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Demer Exc. 7/24/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/sq. ft.	Average Weight per Plot Occurrences F ÷ E	Weight/Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*ARTR	178.00	8.90	-	-	7	-	-	-	-
PLPU	9.00	.45	6.00	-	6	10.52	1.74	1.17	50.50
*OPPO	20.00	1.00	-	-	1	-	-	-	-
AGSM	12.00	.60	8.01	16.80	11	7.00	.64	.58	33.60
BOGR	113.00	5.65	75.38	-	10	12.27	1.23	.13	58.80
POSE	14.50	.70	9.34	-	12	5.63	.47	.39	27.10
BRTE	2.00	.10	1.33	-	4	.49	.12	.24	2.35
*FEOC	1.00	.05	-	-	2	-	-	-	-
TOTAL		7.50				35.91			172.35

*Not computed in Percent Composition

Precipitation Data:

R.G. 8 - Demer Exclosure

October 15 to April 15	=	2.03
April 15 to July 1	=	3.72
July 1 to September 1	=	.54
September 1 to October 15	=	1.74
Growth Season Total	=	6.00

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 No. Plots 20

Cover Determined by Area Estimate

Dutch Nick Flat Exc. 7/11/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute plot Frequency Base 200	Total Weight Gms/200 /sq. ft.	Average Weight per Plot Occurrences F ÷ E	Wgt./ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
CHLA	2.0	.01	.07	-	4	.47	.12	.23	.23
*OPPO	757.5	3.29	-	-	74	-	-	-	-
PLPU	26.5	.13	.88	-	50	9.33	.19	.35	4.48
LEDE	0.5	.00	.00	-	2	.10	.05	.20	.05
OEAL	1.0	.01	.07	-	2	.95	.48	.95	.46
BOGR	2789.0	13.94	94.50	-	198	508.13	2.57	.18	244.00
POSE	132.0	.66	4.47	-	46	33.67	.73	.25	16.17
TOTAL		14.75				552.65			265.39

*Not computed in Percent Composition

Precipitation Data:

R.G. 4 - Dutch Nick Flat

October 15 to April 15	=	1.18
April 15 to July 1	=	5.00
July 1 to September 1	=	.70
September 1 to October 15	=	1.31
Growth Season Total	=	7.01

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 No. Plots 20

Cover Determined by Area Estimate

rson Exc. 9/13/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20 / sq. ft	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*ARTR	152.0	7.60	-	-	9	-	-	-	-
*CHVI	34.0	1.70	-	-	4	-	-	-	-
*PHHO	28.5	1.42	-	-	11	-	-	-	-
*EROV	3.0	.15	-	-	1	-	-	-	-
*ASCA	0.5	.02	-	-	1	-	-	-	-
AGSM	19.0	.95	41.80	-	13	6.48	.50	.34	31.10
POSE	5.0	.25	11.00	-	1	.43	.43	.09	2.06
ORHY	8.5	.42	18.48	-	5	2.73	.54	.32	13.10
SIHY	1.0	.05	2.20	-	1	.09	.09	.09	.43
STCO	12.0	.60	26.40	-	3	1.28	.43	.11	6.14
TOTAL		2.27				11.01			52.83

*Not computed in Percent Composition

Precipitation Data:

G. 2 Farson Exclosure

October 15 to April 15	=	-
April 15 to July 1	=	2.14
July 1 to September 1	=	1.77
September 1 to October 15	=	.82
Growth Season Total	=	4.73

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 No. Plots 20

Cover Determined by Area Estimate

Granite Mtn. Exc. 8/27/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/sq. ft.	Average Weight per Plot Occurrences F ÷ E	Weight/Unit Basal Area F ÷ A	Pounds per Acre
Non-Sprayed	A	B	C	D	E	F	G	H	I
*ARTR	289.5	14.48	-	-	14	-	-	-	-
*AST	1.0	.05	-	-	2	-	-	-	-
*ERI	5.5	.28	-	-	5	-	-	-	-
*ANDI	1.0	.05	-	-	2	-	-	-	-
*CAS	2.0	.10	-	-	1	-	-	-	-
*PHHO	.5	.02	-	-	1	-	-	-	-
POFE	111.0	5.55	81.62	-	18	16.85	.94	.15	80.88
AGSM	25.0	1.25	18.38	-	18	19.03	1.06	.76	91.34
TOTAL		6.80				35.88			172.22
Sprayed									
*ARTR	50.0	2.50	-	-	1	-	-	-	-
*AST	.5	.02	-	-	1	-	-	-	-
*PHHO	4.0	.20	-	-	1	-	-	-	-
POFE	176.0	8.80	73.73	-	17	38.22	2.25	.22	183.46
AGSM	41.0	2.05	26.27	-	17	50.33	2.96	1.23	241.58
TOTAL		10.85				88.55			425.04

*Not computed in Percent Composition

Precipitation Data:

R.G. 6 - Granite Mountain Exclosure

October 15 to April 15	=	-
April 15 to July 1	=	5.01
July 1 to September 1	=	1.59
September 1 to October 15	=	.83
Growth Season Total	=	7.43

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 No. Plots 20

Cover Determined by Area Estimate

Halogeton Pasture Exc. #1 7/16/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 200	Total Weight Gms/200 /sq.ft.	Average Weight per Plot Occurrences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*ARSP	5.0	.02	-	-	1	-	-	-	-
ATNU	1887.5	9.44	94.40	-	123	932.08	7.58	.49	447.40
STA	18.0	.09	.90	-	36	2.34	.06	.13	1.12
LARE	11.5	.06	.60	-	20	7.40	.37	.64	3.55
ALTE	15.5	.08	.80	-	31	9.13	.29	.59	4.38
MONU	11.0	.06	.06	-	21	6.94	.33	.63	3.33
HAGL	33.0	.16	1.60	-	49	62.80	1.28	1.90	30.14
*OPPO	29.0	.14	1.40	-	5	-	-	-	-
SIHY	10.0	.05	.00	-	9	8.42	.94	.84	4.04
TOTAL		9.94				1029.11			493.96

*Not computed in Percent Composition

Precipitation Data:

.G. 24 - Halogeton Pasture

October 15 to April 15	=	1.34
April 15 to July 1	=	3.78
July 1 to September 1	=	.21
September 1 to October 15	=	1.82
Growth Season Total	=	5.81

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 No. Plots 20

Cover Determined by Area Estimate

Halogeton Pasture Exc. #2 7/16/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 200	Total Weight Gms/200 /sq. ft.	Average Weight per Plot Occurrences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
ATNU	3379.0	16.90	98.42	-	165	1273.98	7.72	.38	611.51
HAGL	35.5	.18	1.04	-	70	2.63	.04	.07	1.26
ALTE	5.5	.03	.17	-	11	2.28	.21	.41	1.09
LARE	25.5	.13	.75	-	48	7.83	.16	.31	3.76
*OPPO	12.0	.06	-	-	6	-	-	-	-
STA	5.0	.02	.11	-	10	.27	.03	.05	.13
*DES	1.0	-	-	-	2	-	-	-	-
POSE	2.0	.01	.05	-	1	1.69	1.69	.84	.81
TOTAL		17.27				1286.68			618.56

*Not computed in Percent Composition

Precipitation Data:

G. 24 - Halogeton Pasture

October 15 to April 15	=	1.34
April 15 to July 1	=	3.78
July 1 to September 1	=	.21
September 1 to October 15	=	1.82
Growth Season Total	=	5.81

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 No. Plots 20

Cover Determined by Area Estimate

Halogeton Pasture Exc. #3 7/16/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 200	Total Weight Gms/200 /sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
ATNU	2376.5	11.88	96.82	-	130	1161.10	8.93	.49	557.32
*DES	1.0	-	-	-	2	.61	-	-	-
LARE	14.0	.07	.57	-	28	3.13	.11	.22	1.50
HAGL	48.5	.24	1.96	-	95	3.42	.04	.07	1.64
STA	9.5	.05	.41	-	19	1.08	.06	.11	.52
ALTE	4.0	.02	.16	-	8	1.51	.19	.38	.72
*OPPO	26.0	.13	-	-	4	-	-	-	-
TOTAL		12.26				1170.85			562.01

*Not computed in Percent Composition

Precipitation Data:

R.G. 24 - Halogeton Pasture

October 15 to April 15	=	1.34
April 15 to July 1	=	3.78
July 1 to September 1	=	.21
September 1 to October 15	=	1.82
Growth Season Total	=	5.81

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

Horse Creek Exc. 7/26/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
AGSM TYPE	A	B	C	D	E	F	G	H	I
*ARTR	195.00	9.75	-	-	7	-	-	-	-
*OPPO	16.00	.80	-	-	2	-	-	-	-
*BRTE	.50	.02	-	-	1	-	-	-	-
AGSM	122.00	6.10	60.70	13.80	20	88.02	4.40	.72	422.50
POSE	79.00	3.95	39.30	-	16	15.29	.96	.19	73.39
TOTAL		10.05				103.31			495.89
AGSP TYPE									
*ARTR	332.00	16.60	-	-	6	-	-	-	-
*GUSA	.50	.02	-	-	1	-	-	-	-
*OPPO	12.00	.60	-	-	1	-	-	-	-
*PHHO	.50	.02	-	-	1	-	-	-	-
SPCO	1.50	.08	3.42	-	3	.35	.12	.23	1.68
AGSP	41.50	2.08	88.90	10.80	16	17.43	.97	.42	83.66
AGSM	2.00	.10	4.27	10.00	1	.63	.63	.32	3.02
POSE	1.50	.08	3.42	-	2	.32	.16	.11	1.54
TOTAL		2.34				18.73			89.90

*Not computed in Percent Composition

Precipitation Data:

12 - Horse Creek Exclosure

October 15 to April 15	=	4.25
April 15 to July 1	=	4.34
July 1 to September 1	=	.55
September 1 to October 15	=	1.57
Growth Season Total	=	6.46

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 No. Plots 20

Cover Determined by Area Estimate

Kirby Creek Exc. 7/18/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*SAVE	132.00	6.60	-	-	6	-	-	-	-
SAKA	62.00	6.10	79.30	-	16	160.47	10.03	2.59	770.26
LEPE	5.00	.25	3.25	-	8	3.15	.39	.63	15.12
KOSC	2.00	.10	1.30	-	3	5.56	1.85	2.78	26.69
ATAR	1.50	.08	1.04	-	3	5.63	1.88	3.75	27.02
AGSM	7.00	.35	4.55	22.50	3	10.33	3.44	1.48	49.58
POSE	13.50	.66	8.58	-	4	4.11	1.03	.30	19.73
BRTE	3.00	.15	1.95	-	4	5.51	1.38	1.84	26.45
TOTAL		7.69				194.76			934.83

*Not computed in Percent Composition

Precipitation Data:

Fig. 77 - Kirby Creek Exclosure

October 15 to April 15	=	.16
April 15 to July 1	=	6.44
July 1 to September 1	=	.70
September 1 to October 15	=	1.70
Growth Season Total	=	8.84

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 No. Plots 20

Cover Determined by Area Estimate

Lower Gov't. Draw Exc. 8/20/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds per Acre
Non-Spray	A	B	C	D	E	F	G	H	I
*ARTR	320.50	16.02	-	-	6	-	-	-	-
SPCO	1.00	.05	2.10	-	2	.22	.11	.22	1.06
AST	3.00	.15	6.30	-	1	.82	.82	.27	3.94
AGSM	27.00	1.35	56.71	-	20	41.03	2.05	1.52	196.94
POSE	13.00	.65	27.31	-	11	8.78	.80	.68	42.14
BRTE	1.50	.08	3.36	-	2	1.15	.58	.77	5.52
STCO	2.00	.10	4.20	-	1	1.00	1.00	.50	4.80
TOTAL		2.38				53.00			254.40
Sprayed									
*ARTR	.50	.02	-	-	1	-	-	-	-
*PLPU	.50	.02	-	-	1	-	-	-	-
AGSM	27.00	1.35	26.11	-	17	37.36	2.20	1.38	179.33
POSE	44.00	2.20	42.55	-	17	24.91	1.46	.57	119.57
STCO	32.50	1.62	31.33	-	8	33.60	4.20	1.03	161.28
*BRTE	1.50	.08	-	-	3	-	-	-	-
TOTAL		5.17				95.87			460.18

*Not computed in Percent Composition

Precipitation Data:

R.G. 16 - Lower Government Draw Exclosure

October 15 to April 15	=	1.83
April 15 to July 1	=	6.27
July 1 to September 1	=	1.07
September 1 to October 15	=	.48
Growth Season Total	=	7.82

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 No. Plots 20

Cover Determined by Area Estimate

McGraw Flats Exc. 8/20/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composi-tion	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurr-ences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds Per Acre
	A	B	C	D	E	F	G	H	I
*ARTR	404.00	20.20	-	-	14	-	-	-	-
*CHVI	12.00	.60	-	-	2	-	-	-	-
*ASCA	.50	.02	-	-	1	-	-	-	-
*PHHO	32.00	1.60	-	-	6	-	-	-	-
SPCO	3.00	.15	2.64	-	4	.70	.18	.23	3.36
*ERI	1.50	.08	-	-	2	-	-	-	-
AGSM	10.50	.52	9.15	-	18	10.44	.58	.99	50.11
KOCR	94.00	4.70	82.72	-	11	20.39	1.85	.22	97.87
POSE	5.50	.28	4.93	-	4	1.90	.48	.34	9.12
TOTAL		5.65				33.43			160.46

*Not computed in Percent Composition

Precipitation Data:

Exc. 14 - McGraw Flats Exclosure

October 15 to April 15	=	2.23
April 15 to July 1	=	5.64
July 1 to September 1	=	.87
September 1 to October 15	=	.64
Growth Season Total	=	7.15

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 — No. Plots 20

Cover Determined by Area Estimate

North Butte Thermopolis Relict 10/14/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/sq. ft.	Average Weight per Plot Occurrences F ÷ E	Weight/Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
*SPCO	1.00	.05	-	-	2	-	-	-	-
*OPPO	25.00	1.25	-	-	1	-	-	-	-
*PHHO	6.00	.30	-	-	2	-	-	-	-
AGSM	105.00	5.25	83.48	18.40	20	135.53	6.78	1.29	650.54
BOGR	2.00	.10	1.59	-	1	.60	.60	.30	2.88
*POSE	19.00	.95	-	-	13	-	-	-	-
STCO	12.50	.62	9.86	-	5	8.71	1.76	.70	41.81
CAFI	6.50	.32	5.09	-	3	1.33	.44	.20	6.38
TOTAL		6.29				146.17			701.61

*Not computed in Percent Composition

Precipitation Data:

Thermopolis Weather Bureau Station

October 15 to April 15	=	1.40
April 15 to July 1	=	8.02
July 1 to September 1	=	0.70
September 1 to October 15	=	1.06
Growth Season Total	=	9.78

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x1 No. Plots 20

Cover Determined by Area Estimate

Round Top-Thermopolis Relict 7/25/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 20	Total Weight Gms/20/ sq. ft.	Average Weight per Plot Occurrences F ÷ E	Weight/ Unit Basal Area F ÷ A	Pounds Per Acre
	A	B	C	D	E	F	G	H	I
*ARTR	91.00	4.55	-	-	2	-	-	-	-
*CRAC	5.00	.25	-	-	1	-	-	-	-
AGSP	216.00	10.80	88.60	20.00	18	94.21	5.24	.44	452.50
POSE	5.00	.25	2.03	-	6	.24	.04	.05	1.15
CAFI	20.00	1.00	8.20	-	5	11.95	2.39	.60	57.35
KOCR	1.00	.05	.41	-	1	.00	.00	.00	-
STCO	2.00	.10	.82	-	2	2.88	1.44	1.44	13.82
TOTAL		12.20				109.28			524.82

*Not computed in Percent Composition

Precipitation Data:

Thermopolis Weather Bureau Station

October 15 to April 15	=	1.40
April 15 to July 1	=	8.02
July 1 to September 1	=	0.70
September 1 to October 15	=	1.06
Growth Season Total	=	9.78

HERBAGE AND PRECIPITATION DATA FROM WYOMING HALOGETON EXCLOSURE STUDIES.
(PLOTS LOCATED SYSTEMATICALLY AND WEIGHTS ON OVEN DRY BASIS)

Plot Size 1x10 No. Plots 20

Cover Determined by Area Estimate

Sand Gulch Exc. 7/18/63	Total Trans. Basal Area Percent	Average Percent Basal Area	Percent Composition	Average Height in cm.	Absolute Plot Frequency Base 200	Total Weight Gms/200 / sq. ft.	Average Weight per Plot Occurrences F ÷ E	Wgt./ Unit Basal Area F ÷ A	Pounds per Acre
	A	B	C	D	E	F	G	H	I
ATNU	412.1	2.06	49.85	-	134	1632.45	12.18	3.96	783.58
SAKA	1.0	-	.00	-	2	.53	.26	.53	.25
*SPCO	.00	-	.00	-	2	-	-	-	-
ORHY	28.5	.14	3.39	-	10	31.28	3.13	1.10	15.01
AGSM	248.7	1.24	30.00	-	84	165.60	1.97	.67	79.49
POSE	85.5	.43	10.41	-	32	32.17	1.00	.38	15.44
SIHY	20.0	.10	2.42	-	22	11.39	.52	.57	5.47
BRTE	14.5	.07	1.69	-	12	5.33	.44	.37	2.56
BOGR	2.0	.01	.24	-	2	.15	.08	.08	.07
SPAI	15.0	.08	1.94	-	4	6.94	1.76	.46	3.33
TOTAL		4.13				1885.84			905.20

*Not computed in percent composition

Precipitation Data:

R.G. 75 - Sand Gulch Exclosure

October 15 to April 15	=	2.13
April 15 to July 1	=	7.35
July 1 to September 1	=	.52
September 1 to October 15	=	1.83
Growth Season Total	=	9.70

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